STAR

APRIL 8, 1969

VOLUME 7 • NUMBER 7

N69-17201—N69-18300

DOCUMENTS

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION DIVISION

Scientific and Technical Aerospace Reports, Volume 7, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by the Technical Information Services Company.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966.

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Introduction

WHAT *STAR* IS

Scientific and Technical Aerospace Reports (STAR) is a comprehensive abstracting and indexing journal covering worldwide report literature on the science and technology of space and aeronautics. It is published on the 8th and 23rd of each month.

The following publications are abstracted in *STAR*:

Scientific and technical reports of the National Aeronautics and Space Administration and its contractors; scientific and technical reports of government agencies, universities, and research organizations throughout the world.

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02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **1090**

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Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **1092**

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Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **1101**

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Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **1113**

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Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **1130**

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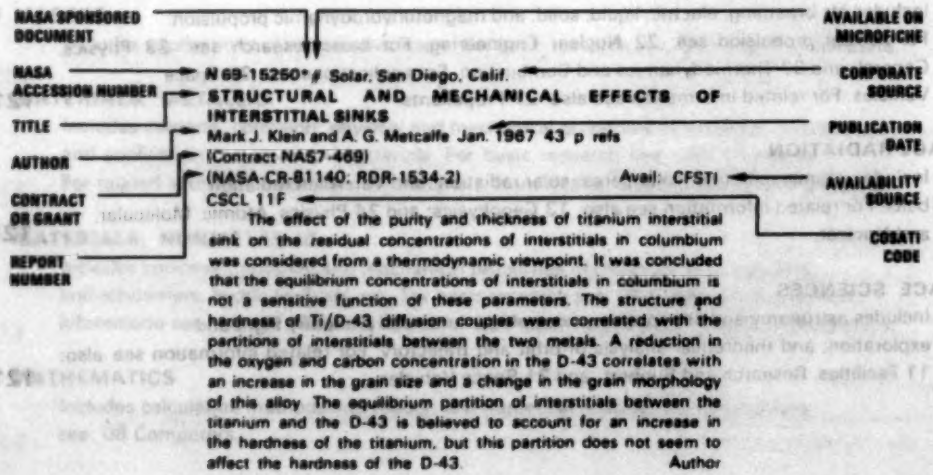
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N69-15250* # Solar, San Diego, Calif.
STRUCTURAL AND MECHANICAL EFFECTS OF INTERSTITIAL SINKS
Mark J. Klein and A. G. Metcalfe Jan. 1967 43 p refs
(Contract NA57-469)
(NASA-CR-81140; RDR-1534-2)
Avail: CFSTI
CSCL 11F
The effect of the purity and thickness of titanium interstitial sink on the residual concentrations of interstitials in columbium was considered from a thermodynamic viewpoint. It was concluded that the equilibrium concentrations of interstitials in columbium is not a sensitive function of these parameters. The structure and hardness of Ti/D-43 diffusion couples were correlated with the partitions of interstitials between the two metals. A reduction in the oxygen and carbon concentration in the D-43 correlates with an increase in the grain size and a change in the grain morphology of this alloy. The equilibrium partition of interstitials between the titanium and the D-43 is believed to account for an increase in the hardness of the titanium, but this partition does not seem to affect the hardness of the D-43.
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-17201 Boeing Co., Seattle, Wash.

EFFECTS OF INTERNAL FLOW ON THE AERODYNAMIC BEHAVIOR OF A JET AIRCRAFT

Pierre Carriere [1968] 47 p Transl. into ENGLISH from French (B-798) Avail: CFSTI

Briefly discussed are the turbulences caused by air intakes in the external flow. The aerodynamic effects of jets are examined, and the principles of jet flow and jet mixing flow are reviewed and discussed, among them the effects of sinks, obstacles, flow separation, and flow recombination. Some typical applications are listed, including pressures on the afterbodies under static conditions and in flight, behavior of overexpanded or underexpanded jets, effects of a propulsion jet or of a flap on an adjacent lift surface, and the effects of blowing. K.W.

N69-17204 Boeing Co., Seattle, Wash.

HOT GAS RECIRCULATION MEASUREMENTS ON FOUR WIND TUNNEL MODELS OF A SIMPLE VTOL CONFIGURATION

Rudolf Jenny [1968] 13 p Transl. into ENGLISH from German (ICAS-68-12) Avail: CFSTI

To determine the influences of wind tunnel size and of the stream temperature upon the recirculation, measurements were made on a simple VTOL configuration. It was found: (1) The size of the model with respect to that of the wind tunnel can have a disturbing influence on the measurement accuracy, since in the case of too large a model the flow field in the wind tunnel cannot be simulated correctly. For large models a limit must be placed on the dynamic pressure ratio so that the floor jet always lies clearly within the wind channel. Details on the allowable jet diameters are given. (2) The value of the exit temperature of the simulated engine jets not only has an influence upon the far-field recirculation but also on the near field. High jet temperatures cause a stronger mixing of the jet with the cold surroundings, so that near the mixing zone the dynamic pressure in the jet also drops off faster than in the case of a cold jet. In many cases, therefore, the results of experiments carried out at low temperatures lead to pessimistic results. Author

N69-17233*# Institut Franco-Allemand de Recherches, St. Louis (France).

ON THE INFLUENCE OF THE COMBINATION OF A FIXED AND AXIALLY SHIFTING ORIFICE PLATE ON THE STABILITY OF A SLENDER BODY WITHOUT TAIL ASSEMBLY AT INCOMPRESSIBLE SUBSONIC SPEEDS [UEBER DEN EINFLUSS DER KOMBINATION EINES FESTEN MIT EINEM LAENGSVERSCHIEBLICHEN STAURAND AUF DIE STABILITAET EINES SCHLANKEN FLUGKOERPERS OHNE LEITWERK IM INKOMPRESSIBLEN UNTERSCHALL

16 Jan. 1967 19 p refs In GERMAN (ISL-ST-2/67) Avail: CFSTI

Described is a dynamic model of a slender rocket body with one orifice plate fastened to the stern and another movable orifice plate between the stern and the gravity point. Shifting of the movable orifice plate changes momentum curves and adjusts to the desired stability for the angle of incidence; thus the amplitude frequency response curve of the oscillating flying body becomes stabilized. Transl. by G.G.

N69-17289*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A PARAMETRIC STUDY OF BLADE-MOTION STABILITY BOUNDARIES FOR AN ARTICULATED ROTOR

Julian L. Jenkins, Jr. Washington Feb. 1969 29 p refs (NASA-TN-D-5032) Avail: CFSTI CSCL 01C

The blade-motion stability and response sensitivity of a fully articulated rotor (flapping and lead-lag degrees of freedom) was examined by using a numerical solution to the coupled, nonlinear, rigid-blade equations of motion. The effect of initial conditions on the tip-speed ratio for divergent motion is indicated by varying the initial azimuth angle for introducing a disturbance and by varying the disturbance amplitude at the critical azimuth angle. Methods of extending the divergence boundary of an articulated rotor are examined. The effects of blade-root pocket cutout, hinge restraint (spring and damping), flapping-hinge cant angle, and hinge offset are evaluated individually, and a representative combination of these parameters was chosen to indicate the overall effectiveness on blade-motion stability and response. Author

N69-17304*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

AERODYNAMIC FORCES ON A STATIONARY AND OSCILLATING CIRCULAR CYLINDER AT HIGH REYNOLDS NUMBERS

George W. Jones, Jr., Joseph J. Cincotta (Martin Co., Baltimore, Md.), and Robert W. Walker Washington Feb. 1969 65 p refs (NASA-TR-R-300) Avail: CFSTI CSCL 20D

A wind-tunnel investigation was made of the steady drag and unsteady lift forces on a stationary and oscillating circular cylinder in two-dimensional flow at high Reynolds numbers and at Mach numbers up to 0.6. The experimental data were obtained in

the Langley transonic dynamics tunnel from tests of a 3-foot diameter cylinder instrumented to measure directly the unsteady lift and mean drag forces on the cylinder. The cylinder could be held fixed or oscillated laterally to the flow at frequencies from 3 to 20 hertz. For the stationary cylinder, the static pressure distributions, the mean drag coefficients at M = 0.2, and the Strouhal number of the unsteady lift forces follow the trends established by previous investigators up to the limits of Reynolds number investigated. At higher Reynolds numbers, each of these parameters remains essentially constant. The unsteady lift force can be categorized into three regimes dependent upon Reynolds number: wide-band random, narrow-band random, and quasi-periodic. Oscillation of the cylinder in the lift direction has no significant effect on the mean drag coefficient. An unsteady lift due to cylinder motion, exists only when the cylinder is oscillated at or relatively near the aerodynamic Strouhal frequency for the stationary cylinder. Author

N69-17312*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC DATA ON LARGE SEMISPAN TILTING WING WITH 0.4-DIAMETER CHORD, SINGLE-SLOTTED FLAP, AND SINGLE PROPELLER 0.22 CHORD BELOW WING

Marvin P. Fink Washington Jan. 1969 205 p refs

(NASA-TN-D-5016) Avail: CFSTI CSCL 20D

A study was made in the full-scale tunnel to determine the longitudinal aerodynamic characteristics of a large-scale semispan V/STOL tilt-wing configuration with a single propeller which was tested for modes of rotation. The wing had a ratio of chord to propeller diameter of 0.4, a 40-percent-chord single-slotted flap, an aspect ratio of 6.14 (3.07 for the semispan), a taper ratio of 1.0, and an NACA 4420 airfoil section. The direction of propeller rotation was found to have a very significant effect on the lift and descent capability (as determined from drag–lift ratios attainable without stalling of any part of the wing within the propeller slipstream) and that up-at-the-tip rotation gave the more favorable results. The use of flow-control devices was very effective in increasing the descent capability and lift for down-at-the-tip propeller rotation where the characteristics without such devices were poor but was much less effective for up-at-the-tip propeller rotation. For the most favorable combination of the configuration variables, descent angles of nearly 27° were achieved over the entire test range of power conditions. Author

N69-17392*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYTICAL INVESTIGATION OF THE EFFECT OF COOLING AIR ON TWO-STAGE TURBINE PERFORMANCE

Warren J. Whitney Washington Jan. 1969 24 p refs

(NASA-TM-X-1728) Avail: CFSTI CSCL 21E

Turbine efficiency is determined as a function of inlet temperature by using the isolated-flow analytical method. The parameters that are varied are coolant total-pressure coefficient, coolant to inlet temperature ratio, and velocity-diagram type. The general results are used to determine the efficiency-temperature trend for two example turbine applications. Author

N69-17398*# National Aeronautics and Space Administration. Langley Research Center, Langley Station Va.

PERFORMANCE OF A TOWED, 48-INCH-DIAMETER (121.92-cm) BALLUTE DECELERATOR TESTED IN FREE FLIGHT AT MACH NUMBERS FROM 4.2 TO 0.4

J. W. Usry Washington Feb. 1969 34 p refs Film supplement number L-1002 to this report is available on loan from NASA, Langley Research Center, Langley Station, Va.

(NASA-TN-D-4943) Avail: CFSTI CSCL 01C

A ballute decelerator inflated by ram air was tested in free flight to determine the inflation, drag, and stability characteristics. The decelerator has a 40-inch (101.6-cm) envelope equatorial diameter and a 10-percent burble fence. It was towed 13.5 feet (4.12 m) aft of a cone-cylinder-flare payload with a maximum diameter of 18.21 inches (46.25 cm). The decelerator was deployed at an altitude of 115,000 feet (35.1 km) at a velocity of 4400 ft/sec (1342 m/sec) and inflated at a Mach number of 4.2 and a free-stream dynamic pressure of 163 lb/ft^2 (7.8 kN/m^2). The time from the beginning of inflation of the decelerator to full inflation was 0.42 second. Longitudinal loads during inflation were of the same order of magnitude as the steady-state drag load. The decelerator appeared to have excellent stability characteristics in pitch and yaw during and after inflation. Roll rates of both bodies increased after deployment from a minimum of about 2.6 radians/sec just prior to inflation to a maximum of about 6.8 radians/sec for the decelerator and about 5.8 radians/sec for the payload. The drag coefficient of the decelerator varied from about 1.45 at a Mach number of 1.25 to 0.67 at a Mach number of 4.2 Author

N69-17448# Boston Univ., Mass. Engineering Labs.

VORTEX INDUCED ROLLING MOMENTS ON FINNED MISSILES AT HIGH ANGLE OF ATTACK

Daniel G. Udelson Nov. 1968 55 p refs

(Contract F19628-68-C-0148)

(AD-679755; SR-1; AFCRL-68-0569) Avail: CFSTI CSCL 19/1

Previous analytical studies endeavoring to account for vortex induced rolling moments on missiles have not successfully correlated with experimental results. This points up the need for a theoretically more sophisticated treatment, which the present work attempts to satisfy. A model for the two dimensional cross flow past the tail body combination is employed and the Blasius complex contour integral used to find the moments. The final result contained herein presents the complete mathematical solution for the two dimensional ideal flow past a planar tail body combination. It is in closed analytic form with the exception of one definite integral which has been reduced to a form suitable for numerical calculation. All terms of the solution (integrated as well as the integral) are best calculated for various values of the parameters on a large scale digital computer. TAB

N69-17488# Aeronautical Research Labs., Melbourne (Australia).

INITIAL BOUNDARY LAYER MEASUREMENTS ON C4 BLADES IN THE VORTEX WIND TUNNEL

G. J. Walker (Tasmania Univ.) Apr. 1968 35 p refs

(ARL/ME-293) Avail: CFSTI

A hot wire anemometer has been used to measure velocity profiles in the boundary layer of a stator blade in the vortex wind tunnel. Values of boundary layer thickness and shape parameters calculated from the measured velocity profiles are in fair agreement with values predicted by Thwaites's method from the measured surface pressure distribution. China clay visulization studies have been made on the rotor and stator blades, and lines of turbulent flow reattachment following laminar flow separation have been measured. Some investigations of regions of separated laminar flow are reported. The behavior of laminar separation bubbles on blades in the vortex wind tunnel appears to differ markedly from that observed on isolated aerofoils at high Reynolds Number. Author

N69-17816*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TWO DIMENSIONAL INVISCID JET FLOW FROM TWO NOZZLES AT AN ANGLE TO A PLANE SURFACE

Marvin E. Goldstein and Robert Siegel Washington Feb. 1969 45 p refs

(NASA-TN-D-5064) Avail: CFSTI CSCL 20D

Conformal mapping was used to obtain the free streamlines and wall pressure coefficient for jets issuing from two nozzles and striking a surface. The jet nozzle exit planes are at an angle to the surface and can be spaced an arbitrary distance apart and an arbitrary distance from the surface. The effect of nozzle position and tilt angle on the extent of the flow back between the nozzles is

shown. The back flow results from a collision between part of the flow from each jet that has been turned by striking the plate. Author

N69-17818*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FORTRAN PROGRAMS FOR CALCULATING WIND-TUNNEL BOUNDARY INTERFERENCE

Harry H. Heyson Washington Feb. 1969 74 p refs

(NASA-TM-X-1740) Avail: CFSTI CSCL 20D

Boundary-interference programs, developed in NASA TR R-302, are presented without comment. These programs should be utilized only after careful consideration of the assumptions and procedures given in that report. A systematic computer procedure is developed for calculating the wind tunnel interference factors for arbitrary configurations from the interference calculations for a vanishingly small model. The method is not limited to any one tunnel configuration since it is necessary only to substitute a subroutine appropriate to the tunnel for that given herein. The underlying theory (subroutine DLTAS) in the present computer programs is directly applicable to models which produce large wake deflections, such as V/STOL models. These programs may also be used directly for more conventional testing at moderate lift coefficients by means of the few simple modifications. No sample calculations or check cases are provided. Author

N69-17831*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THEORETICAL ANALYSIS OF FLOW IN VTOL LIFT FAN INLETS WITHOUT CROSSFLOW

Norbert O. Stockman and Seymour Lieblein Washington Feb. 1969 39 p refs

(NASA-TN-D-5065) Avail: CFSTI CSCL 20D

A method based on the Douglas incompressible potential-flow computer program has been used for the theoretical analysis of the axisymmetric flow in VTOL lift fan or engine inlets in static operation (no crossflow). The usefulness of the method for predicting flow in real inlets without flow separation was indicated by good agreement between theoretical results and limited available experimental compressible data. Example solutions were given for several different inlet configurations in which shroud curvature and depth, centerbody size and location, and inlet boundaries (type of installation) were varied. The application of the method to the design of an actual fan-in-wing inlet was given in some detail. Author

N69-17924# Institut Franco-Allemand de Recherches, St. Louis (France).

CONTRIBUTION TO THE EXPERIMENTAL STUDY OF THE MAGNUS EFFECT. PART 2: CASE OF THE CONE-CYLINDER STABILIZED BY ROTATION

J. P. Renevier and M. Giraud 21 Mar. 1967 84 p refs In FRENCH

(ISL-T-8/67) Avail: CFSTI

Experimental tests were performed to determine the Magnus coefficient of a free flight spin-stabilized projectile with conical cylindrical shape. Direct and indirect reconstruction of projectile spin around its gravity point is correlated with measured kinematic values by least square methods of matrix algebra and programmed for computer analysis. Author

N69-18017# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINING THE SERVICE LIFE OF AN AIRCRAFT WING DURING AERODYNAMIC HEATING

S. S. Krestovskiy 16 Apr. 1968 13 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. (Kazan), no. 91, 1966 p 139–147

(AD-679717; FTD-HT-23-305-68) Avail: CFSTI CSCL 1/3

The article examines an approximate method of determining the service life of an aircraft wing of the usual thin-walled design under aerodynamic heating conditions and loaded with bending moment M sub x. The change in value of M sub x over the course of a typical aircraft flight is prescribed. Here the factor determining the service life of the structural component is the bending deformation limit tolerated by operating conditions. The change in stress distribution in the component when there is creep is also determined in the computational process. Author (TAB)

N69-18191# Rensselaer Polytechnic Inst., Troy, N. Y.

JET FLAPPED AIRFOILS IN GROUND PROXIMITY

George C. Cooke, IV Jan. 1968 70 p refs

(Contract C-117-66-(NEG); Grant NSF GK-618)

(TR-AE-6804; PB-180277) Avail: CFSTI CSCL 13F

The paper concerns the subsonic lift characteristics of airfoils in ground proximity with and without trailing edge jet flaps. The study is restricted to the supercritical flow problem in which the jet flap does not impinge upon the ground. A linearized potential flow model in the form of integro-differential equations is constructed to analyze this physical problem. Solutions for the airfoil vortex intensity and jet-flap shape are found by representing these functions in a continuous manner by trigonometric series with unknown coefficients. The resulting algebraic equations are then solved by a pivotal points procedure. An alternate method for determining the lift characteristics of airfoils in ground proximity without jet flaps is also presented. Author (USGRDR)

N69-18224# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).

INFLUENCE OF INTERNAL FLOW ON THE AERODYNAMIC BEHAVIOR OF JET AIRCRAFT [EFFETS DE L'ECOULEMENT INTERNE SUR LE COMPORTEMENT AERODYNAMIQUE D'UN AVION A REACTION]

Pierre Carrière 1968 39 p refs In FRENCH; ENGLISH summary Presented at the 6th Intern. Congr. of Aeron. Sci., Munich, 9–13 Sep. 1968 Submitted for publication

(ONERA-TP-601) Avail: CFSTI

The fluxes of air in today's turbojets have become so important that it is no longer possible to neglect the interactions between the external and the internal flows. The rather well-known problems caused by the disturbances that the air inlet can cause in the external flow are briefly surveyed. The jet aerodynamic effects whose study is still lacunary are considered, and fundamental knowledge on the properties of jets and their confluence are reviewed and discussed (sink effects, obstacle effects, mixing, and reattachment of two fluid sheets). Finally some typical applications are mentioned, like induced pressure on afterbodies (in no translation conditions and in-flight), behavior of jets (over or under-expanded), action of a propulsive jet on a neighboring lifting surface, blowing effects, etc. Author (ESRO)

N69-18225# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).

EXPERIMENTAL RESEARCH ON SUPERCRITICAL WING PROFILES RECHERCHES EXPERIMENTALES SUR DES PROFILS D'AILES SUPERCRITIQUES]

Michel Vincent de Paul 1968 16 p refs In FRENCH; ENGLISH summary Presented at the Meeting of AGARD Group of Fluid Mech. on Transonic Aerodyn., Paris, 18–20 Sep. 1968 Submitted for publication

(ONERA-TP-632) Avail: CFSTI

Some upper-surface velocity distributions having a peak near the profile leading-edge are studied. It is well known that this type of distribution always appears when profiles are at incidence but it can also be imposed at the design incidence. In the first case the peak governs the separation at the leading-edge, at low speed and high lift; in the second case, at the moderate lift encountered at high speed, this peak determines the mechanism of the shock formation. To examine these problems, a family of symmetrical profiles has been defined, starting from velocity distribution laws in

incompressible flow, at zero angle of attack, as a function of the peak position and intensity and also of the following recompression gradient. The study of the evolution of the curvature in the leading-edge region of the calculated profiles, led to classify them into four main categories. The experimental analysis aims at criticizing the aerodynamic qualities of such profiles at low speed (maximum lift) as well as in the transonic range (drag and lift divergence Mach number). The first experimental results presented concern tests in transonic flow. Author (ESRO)

N69-18262# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
EXPERIMENTAL STUDY OF THE NEAR WAKE OF AXISYMMETRIC BODIES IN SUPERSONIC FLOW [ETUDE EXPERIMENTALE DU PROCHE SILLAGE DE CORPS DE REVOLUTION EN ECOULEMENT SUPERSONIQUE]
Maurice Sirieix, Jean Delery, and Bernard Monnerie 1968 12 p refs Presented at the 19th Intern. Congr. of Astronautics, N.Y., 13–19 Oct. 1968 Submitted for publication
(ONERA-TP-608) Avail: CFSTI

An experimental analysis is presented of the base flow in the turbulent case at Mach number 1.92 and 4.00 on axi-symmetrical afterbodies held by a forward sting. The structure of the recirculation flow and the expansion of an initial boundary layer are particularly outlined. The separation conditions on curved afterbodies are especially examined at Mach 1.92. ESRO

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-17257*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC TRANSPORT OPERATING PRACTICES DURING SIMULATED OPERATIONS IN FUTURE AIR TRAFFIC CONTROL SYSTEM ENVIRONMENTS
Milton D. McLaughlin and Richard H. Sawyer Washington Feb. 1969 65 p refs
(NASA-TN-D-5018) Avail: CFSTI CSCL 01B

Operating practices of the supersonic transport (SST) during simulated operations in air traffic control (ATC) system environments conceived for the time period for introduction of the SST into service are presented. An SST flight simulator and the Federal Aviation Administration ATC simulation facilities were used to create the real-time simulations. The SST flight simulator was operated by airline crews and the ATC simulation facilities by experienced air traffic controllers. The test program included departure and arrival operations under instrument flight rule conditions in the New York and Los Angeles terminal areas with two design study configurations of the SST. The design study configurations were representative of variable-sweep and fixed-wing designs. Both designs had a variable-incidence forebody. Author

N69-17279*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
VARIABILITY IN SONIC-BOOM SIGNATURES MEASURED ALONG AN 8000-FOOT LINEAR ARRAY
Domenic J. Maglieri, Vera Huckel, Herbert R. Henderson, and Norman J. McLeod Washington Feb. 1969 58 p refs
(NASA-TN-D-5040) Avail: CFSTI CSCL 20A

Systematic measurement studies designed to minimize all effects other than those of the local atmosphere are presented to document the variability of sonic-boom signatures at ground level. Measurements from an 8000-foot (2438-meter) linear microphone array indicate that wavelike overpressure patterns in which the signature shapes progress from peaked to rounded vary with time. Such variations are believed to be attributable to the atmosphere rather than to the airplane motion. Analyses of data for the same instruments, test array, time period, airplane altitude, and airplane type, and for Mach numbers of 1.3 and 1.6, suggest that less variability in pressure, impulse, period, and rise time exists for the Mach number 1.6 data. The probability of equaling or exceeding the ratio of measured to calculated over-pressure, impulse, and time durations for the F-104 fighter airplane has been determined from a sample of more than 2500 data points for different operating conditions, geographical locations, and climatic conditions. The results suggest that the logarithms of these quantities follow a normal distribution. Author

N69-17303*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
FULL-SCALE WIND-TUNNEL INVESTIGATION OF STATIC LONGITUDINAL AND LATERAL CHARACTERISTICS OF A LIGHT TWIN-ENGINE AIRPLANE
Marvin P. Fink and Delma C. Freeman, Jr. Washington Jan. 1969 217 p refs
(NASA-TN-D-4983) Avail: CFSTI CSCL 01B

An investigation was conducted in the Langley full-scale tunnel to determine the static longitudinal and lateral stability and control characteristics of a full-scale light twin-engine airplane. Hinge moments were also measured for all control and flap surfaces during the investigation. In general, the airplane was found to have stick-fixed longitudinal stability through the stall, but stick-fixed instability could be encountered at some lift coefficients with rearward center of gravity location. The airplane has stick-free stability through the stall, however, for all power, flap, and center of gravity conditions investigated. At angles of attack below the stall, the airplane is directionally stable, has positive effective dihedral, and the variation of the lateral coefficients is fairly linear. At angles of attack above the stall, the airplane is directionally stable, and has positive effective dihedral for all conditions except at a thrust coefficient of 0. However, rolling and yawing moments greater than those produced by full opposite control occur at zero sideslip because of asymmetrical wind stall. Aileron and rudder effectiveness is maintained through the stall. Author

N69-17542# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE TESTS ON THE CESSNA 180 WING AND STRUT
M. B. Benoy, F. E. Verinder, and T. S. Maddock Oct. 1967 86 p refs
(ARL/SM-318) Avail: CFSTI

A full scale fatigue test has been carried out on two new port wings and one lift strut, and a repair scheme proved effective in extending the life of the first wing specimen. Tests showed that the wing had a high residual strength in the cracked condition, and the rates of fatigue crack propagation were low. It therefore appears that wings could be operated safely on a restricted fail-safe basis, particularly if the radiographic inspection technique developed during the test is used in support of visual inspections. The same strut was used for all wings during the tests and was virtually undamaged at the end of the investigation. Laboratory and flight strain measurements indicated that service failures of the rear spar at the wing root were due to the landing and taxing inertia

loads peculiar to the agricultural aircraft in which the failures occurred. The equivalent service lives based on the life to failure under the laboratory test loading are presented for aircraft operation in the agricultural, civil charter, military, and civil training roles. Author

N69-17670# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.

AN INVESTIGATION OF THE DYNAMIC STABILITY CHARACTERISTICS OF A QUAD CONFIGURATION, DUCTED-PROPELLER V/STOL MODEL. VOLUME 1: PHASE 1, HOVERING Final Data Report

William F. Putman, Joseph J. Traybar, Howard C. Curtiss, Jr., and John P. Kukon Ft. Eustis, Va. US Army Aviation Mater. Labs. Sep. 1968 118 p refs /*ts* Aerospace Sci. Rept. 835

(Contract DAAJ02-67-C-0025)

(AD-679134; USAAVLABS-TR-68-49A) Avail: CFSTI CSCL 1/3

Results are presented of experiments conducted to measure the dynamic stability characteristics of a quad configuration, ducted-propeller, dynamically similar model, V/STOL aircraft near hover. The data presented include longitudinal and lateral transient response characteristics of the dynamic model. Also included is a comparison with full-scale duct characteristics of the lift, drag, and pitching moment characteristics of an isolated duct from the model. The model employed in the experiments is a generalized research model which was arranged to represent closely the X-22A V/STOL aircraft. The data presented in the report represent the first phase of a three-phase investigation of the dynamic stability of this type of V/STOL aircraft. The other two phases pertain to the longitudinal and lateral/directional characteristics at four low-speed and high-duct-incidence trim conditions. Author (TAB)

N69-17700*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

INVESTIGATION OF OPENING CHARACTERISTICS OF AN ALL-FLEXIBLE PARAWING

Thomas G. Gainer Washington Feb. 1969 32 p refs

(NASA-TN-D-5031) Avail: CFSTI CSCL 01C

Opening forces for an all flexible parawing were measured during deployments made in the 17 foot section of a wind tunnel. The wing tested had a nominal keel length of 5 feet, a flat pattern leading edge sweep of 45°, and equal length leading edges and keel. Lift and drag coefficient time histories were obtained by measuring three components of the total force on the wing. Tunnel dynamic pressure was varied from 0.5 to 2.0 pounds per square foot. Two slotted versions of the wing were also tested and some exploratory tests of a reefing technique of shortening one of the keel suspension lines were made. The results indicated that as the wing opened, there was a buildup in both lift and rage coefficient to large values. The ratio of maximum resultant force coefficient to steady state resultant force coefficient (shock factor) was about 3.0. When the resultant force reached a maximum, it was inclined about 48° to the airstream. For the infinite mass conditions of the tests, filling time was about 2.5 times the ratio of keel length to velocity. The complete force time history, including both the opening force and the forces during the transition to steady state angle of attack, could be nondimensionalized with respect to filling time. Opening forces for a 5 foot wing calculated by using the wind-tunnel data were in excellent agreement with drop test data. Author

N69-17741# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

GENERAL ACTIVITY AND ECONOMIC REPORT FOR 1967 [ALLGEMEINER TAETIGKEITS UND WIRTSCHAFTSBERICHT FUER 1967] Annual Report

1968 114 p refs In GERMAN

Avail: CFSTI

This comprehensive report covers economic aspects, an expanding building program, and brief reports on scientific studies performed at the German Research Institute for Aeronautical and Space Flight Sciences during 1967. Transl. by G.G.

N69-17778# Royal Aircraft Establishment, Farnborough (England).

THE USE OF LOAD FREQUENCY DISTRIBUTIONS IN THE SPECIFICATION OF DESIGN REQUIREMENTS FOR COMMERCIAL AIRCRAFT [HAEUFIGKEITSVERTEILUNGEN ALS BESTANDTEIL DER LASTANNAHMEN FUER VERKEHRSFLUGZEUGE]

O. Buxbaum and E. Gassner Jun. 1968 27 p refs Transl. into ENGLISH from Luftfahrttech.-Raumfahrttech. (West Ger.), v. 13, no. 4, 1967 p 78-84

(RAE-LIB-TRANS-1303) Avail: CFSTI

The spectrum of center of gravity acceleration is shown by examples to be inadequate for the fatigue strength estimation of commercial aircraft. It is postulated that for design purposes a load spectrum must be established based on a typical flight profile, from which mean and dynamic stresses can be estimated. From extensive measurements during flight it is shown that spectra recurring in different load cases, such as gusts, maneuvers, landings and during taxiing, in commercial aircraft are very similar, and it is recommended that so called universal spectra should be established. Author

N69-17823# Honeywell, Inc., St. Paul, Minn. Research Dept.

INVESTIGATION OF THE EFFECTS OF GUSTS ON V/STOL CRAFT IN TRANSITION AND HOVER Final Technical Report, Apr. 1967–Mar. 1968

Grant B. Skelton Wright-Patterson AFB, Ohio AFFDL Oct. 1968 246 p refs

(Contract F33615-67-C-1563)

(AD-679593; AFFDL-TR-68-85; ADG-12060-FRI) Avail: CFSTI CSCL 1/3

The concern in the work reported is the development of statistical models for the gust environment in the earths boundary layer for use in determining the gust response characteristics of V/STOL aircraft. A general gust model based upon published gust data was developed, and analyses of V/STOL responses with that model were conducted to determine the gust descriptors significant to V/STOL performance. An interim gust model embodying the significant descriptors was then developed for use in V/STOL gust analyses. Suggestions for meteorological experiments to measure the significant descriptors are made. The significant gust descriptors determined from the analyses are the diagonal terms of the gust covariance tensor, gust probability distributions, mean wind probability distributions, and the dependencies of these statistics on thermal stability, surface roughness, and altitude. Less critical descriptors include the off-diagonal components in the gust covariance tensor and the space-time interplay in that tensor. The significant gusts seen by the aircraft are head-on and vertical gusts on the wings; head-on and vertical gust sheers across the wings; head-on, side, and vertical gusts on the tail; and head-on and side gusts on the fuselage. Mean airspeed and sideslip angle are important parameters in V/STOL gust responses. The wing-to-tail transport delay of the gusts in forward flight also has a significant effect. V/STOL gust responses at low airspeeds are generally small due to the low dynamic pressures, and the responses are decidedly nonlinear except at low gust amplitudes. Author (TAB)

N69-18123# Federal Aviation Administration, Atlantic City, N. J. National Aviation Facilities Experimental Center.

TEST AND EVALUATE TAKE-OFF AND GO-AROUND SYSTEM Final Report

Richard W. Cleary Feb. 1969 27 p

(FAA-NA-69-4; RD-69-1) Avail: Issuing Activity

Automatic throttles, take-off information displayed on the flight director, and go-around information displayed on the flight

director, all using angle of attack as the primary control reference, were evaluated in a DC-7 aircraft. Phototheodolite position data and oscillograph recordings from an onboard recorder were used to measure performance. It was concluded that the automatic throttles were compatible with flight director approaches and with landings performed with the aircraft automatic landing system. The go-around information was used to perform go-around without reference to attitude or airspeed. Four engine and three engine takeoffs were performed with conventional instruments and with the flight director. Performance was more consistent when the flight director was used. Author

N69-18146# Abt Associates, Inc., Cambridge, Mass.
WASHINGTON–BALTIMORE AIRPORT ACCESS SURVEY. VOLUME 1 Summary Report
May 1968 150 p
(Contract DT-735133)
(PB-179573) Avail: CFSTI CSCL 01E

This section presents a summary of the findings of the study utilizing a visual presentation of the data. Graphs are presented that summarize the information given in greater detail in Chapters 2 through 7. A commentary is provided to highlight the most important information. Author (USGRDR)

N69-18147# Abt Associates, Inc., Cambridge, Mass.
WASHINGTON–BALTIMORE AIRPORT ACCESS SURVEY. VOLUME 2: BASIC TABULATION Summary Report
May 1968 186 p
(Contract DT-735133)
(PB-179574) Avail: CFSTI CSCL 01E

The Washington–Baltimore airport access survey has been documented in four volumes. This volume, which provides the reader with the basic data tabulations, is the second of the series. To aid in correlating the data provided in the volume to that provided in the others, particularly volume one, an introductory section is provided which contains maps of the Washington–Baltimore region showing the general geographic boundaries of the study districts, a table of selected areas which provides the numbers of the study districts used, a table of specified times which shows the numbers of the study districts that can be reached by certain specified driving times from the airports, and a dictionary of study district boundaries providing detailed geographic descriptions of the study district boundaries. Author (USGRDR)

N69-18148# Abt Associates, Inc., Cambridge, Mass.
WASHINGTON–BALTIMORE AIRPORT ACCESS SURVEY. VOLUME 3: A CASE STUDY Summary Report
May 1968 95 p
(Contract DT-735133)
(PB-179575) Avail: CFSTI CSCL 01E

This volume discusses the Washington–Baltimore airport access survey as a special illustrative case including the important events and problems that arose from survey conception, to execution, to results. Alternatives considered at critical points in the development of the survey are given in some detail along with the reasons for the choices made. This volume will hopefully provide information and background to those who are considering planning other airport access studies. Author (USGRDR)

N69-18149# Abt Associates, Inc., Cambridge, Mass.
WASHINGTON-BALTIMORE AIRPORT ACCESS SURVEY. VOLUME 4: DATA PROCESSING USERS MANUAL Summary Report
May 1968 167 p
(Contract DT-735133)
(PB-179576) Avail: CFSTI CSCL 01E

This document describes the data processing system developed to process the questionnaire data collected in the survey phase of the airport access study. As originally conceived, this was to have been a general purpose system, directly applicable to the processing of survey data for any airport. In the course of its development, however, it evolved into a system directly applicable to the processing of the data for the Washington-Baltimore airport access survey. Author (USGRDR)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-17225*# National Aeronautics and Space Asministration. Lewis Research Center, Cleveland, Ohio.
A METHOD FOR REDUCING THE EQUIVALENT SINK TEMPERATURE OF A VERTICALLY ORIENTED RADIATOR ON THE LUNAR SURFACE
Darl D. Bien and Donald C. Guentert Washington Jan. 1969 17 p refs
(NASA-TM-X-1729) Avail: CFSTI CSCL 13A

An aluminized plastic cover sheet over the lunar surface immediately surrounding a vertical radiator offers a simple, light-weight method for reducing the radiator equivalent sink temperature. A simplified analysis predicts equivalent sink temperature as a function of cover surface coating properties, cover length, and radiator elevation for a radiator in the lunar equatorial plane. Results indicate that equivalent sink temperature can be reduced from over 600°R (333°K) (no cover) to about 400°R (200°K) (with cover). The corresponding reduction in required radiator area is about 50 percent for a radiator temperature of 700°R (389°K). The effect of operation off the lunar equator is also discussed. Author

N69-17227 Florida Univ., Gainesville.
A THEORETICAL INVESTIGATION AND EXPERIMENTAL VERIFICATION OF THE TWO-PHASE HEAT TRANSFER CHARACTERISTICS OF A COMBINED SOLAR COLLECTOR-GENERATOR FOR A SOLAR AIR CONDITIONER
Gordon Lee Moore (Ph.D. Thesis) 1967 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-9543

In the interest of reducing or eliminating heat loss, a theoretical study was made of the various possible configurations which could serve the dual role of both a solar collector and an ammonia generator. The theoretical analysis of the combined solar collector-generator and the results of the series of experimental investigations indicated the following advantages resulting from combining the two units into one: (1) The undesirable heat loss that occurs between solar collector and the seperate generator of previous solar refrigeration systems is eliminated in the combined collector-generator. (2) The flat plate type solar collector-generator can generate substantial amounts of ammonia even on cloudy days when only diffuse solar energy is available. (3) The solar collector-generator developed can generate the equivalent of 30 pounds of ice per day with only a 4 by 4 foot collector area. (4) The combined collector-generator has a relatively short warm-up time. Dissert. Abstr.

N69-17273# Institut Franco-Allemand de Recherches, St. Louis (France).
DESIGN AND TESTING OF A COAXIAL X-RAY FLASH GENERATOR CAST IN ARALDIT [KONSTRUKTION UND ERPROBUNG EINES IN ARALDIT EINGEGOSSENEN KOAXIALEN ROENTGENBLITZGENERATORS]
G. Thomer, H. Gulitz, and G. Heinz 17 Aug. 1967 31 p refs in GERMAN
(ISL-T-27/67) Avail: CFSTI

Described is an X-ray flash apparatus that incorporates a high frequency generator composed of encapsulated ring elements. Each element contains a separate sealed-in spark gap besides condensor and resistors. The coaxial arrangement minimizes self induction. The X-ray flash tube in the generator axis can be used as either diode or triode. This X-ray flash generator produces X-ray impulses of 200 ns at voltages between 200 and 330 kV and is suitable for final ballistic analyses. Transl. by G.G.

N69-17337*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATED HYDROGEN CROSS-LEAKAGE IN A LOW-TEMPERATURE, CONTAINED-ELECTROLYTE HYDROGEN-OXYGEN FUEL CELL
N. H. Hagedorn Washington 1969 13 p refs
(NASA-TM-X-52542) Avail: CFSTI CSCL 10B

A fuel cell was operated at temperatures of 120°, 135°, and 150°F, and current levels of 10, 25, and 50 amperes. A cathode feed stream mixture containing oxygen and 0 to 20 percent hydrogen (by volume) was metered to the fuel cell. There existed a minimum feed rate of this mixture which was required to sustain cell performance at each operating point. The hydrogen portion of the mixture was completely consumed by combustion in all cases. At the required minimum feed rate, about 10 percent more oxygen (by weight) entered the fuel cell than was required by the fuel cell current and for the hydrogen combustion. The excess oxygen (ventage) was necessary to prevent buildup of inerts (An, N_2, CO_2) present in the oxygen supply. The hydrogen content of the feed stream had no effect on cell voltage, provided the minimum feed rate requirement was met or exceeded. Author

N69-17393*# TRW Systems, Redondo Beach, Calif.
STUDY OF RADIATION EFFECTS IN Li-DOPED SILICON SOLAR CELLS Quarterly Report, Aug.–Oct. 1968
R. G. Downing, J. R. Carter, and W. K. Van Atta 15 Nov. 1968 40 p Prepared for JPL
(Contracts NAS7-100; JPL-952251)
(NASA-CR-73889; TRW-10971-6008-R0-000 QR-2) Avail: CFSTI CSCL 10B

Studies of the annealing of irradiated lithium doped crucible silicon solar cells indicate considerable improvement over previous devices with annealing times of the order of 10 days at room temperature. A group of float zone lithium doped solar cells were studied as a function of redistribution time at 250°C. The lithium concentration at the junction is observed to rise rapidly until a maximum is reached after which further redistribution reduces the lithium concentration to an undetectable value. Short circuit current is reduced as the lithium concentration near the junction reaches a maximum value. Carrier removal studies indicate a deep lying acceptor defect which may be responsible for observations of incomplete annealing of lithium doped cells. The use of $LiAlH_4$ as a diffusion source eliminates the mechanical problems associated with more commonly used paint-on oil suspensions. Using longer diffusion times, wafers of uniform resistivities ranging from 0.01 to 0.5 ohm-cm have been prepared in this manner. Author

N69-17557# Babcock and Wilcox Co., Barberton, Ohio. Power Generation Div.
SODIUM TO STEAM HEAT EXCHANGER ELEMENTS AND RESEARCH Interim Report. Preliminary Steam Generator Concept Selection Study
5 Aug. 1968 94 p refs
(Contract AT(11-1)-1280)
(BAW-1280-55) Avail: CFSTI

In order to select the most optimum steam generator design for the Liquid Metal Fast Breeder Reactor Program, ninety-six possible designs were considered. From these, five alternates and a reference design were selected for further study. The selected designs were: (1) Modular, Forced recirculation, Drainable, Vertical Straight Tube Unit; (2) Modular, Once-through, Drainable, Vertical and Horizontal Straight Tube Units; (3) Modular, Once-through, Drainable, Horizontal, U-Tube Unit; (4) Large, Once-through, Drainable, Vertical, Return Bend Unit; (5) Large, Once-through, Drainable, Vertical, Helical Coil Unit; and (6) (Reference Design)–Large, Once-through, Undrainable, Vertical, Helical Coil Unit. The program plan for the preliminary analysis of the selected designs has been made and included in the report. The result of this analysis will be the selection of the most optimum sodium heated steam generator design. Author (NSA)

N69-17587# Dayton Univ., Ohio. Research Inst.
COMPUTER PROGRAM FOR THE CALCULATION OF ELECTRIC FIELDS IN AN ELECTROFLUIDDYNAMIC GENERATOR Final Report, 1 Jul. 1965–30 Jun. 1968
John E. Minardi Aug. 1968 164 p refs
(Contract AF 33(615)-3203)
(AD-680006; ARL-68-0156; UDRI-TR-68-37) Avail: CFSTI CSCL 20/9

A computer program for the determination of the electric field within an electrofluiddynamic generator is presented. The program produces constant potential lines, constant radial (or transverse) field intensity lines, constant axial field intensity lines and lines of constant magnitude of electric field intensity. The program is suitable for two-dimensional or axisymmetric geometries. A listing of the program is presented with a discussion of the input and output that will enable an independent investigator to use the program. Also presented is an example problem including the input and output. Author (TAB)

N69-17624# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE ELEMENTS OF THE FLOW PART OF LOW FLOW RATE CENTRIFUGAL STAGES
Yu. B. Galerkin et al 3 May 1968 16 p refs Transl. into ENGLISH from Politekhnicheskiy Inst. Tr. (Leningrad)
(AD-679797; FTD-HT-23-1341-67) Avail: CFSTI CSCL 13/7

The paper discusses the most general experimental results and compares the respective efficiencies of the various designs. After presenting the basic parameters of the stages under study, the report presents the influence of the relative width on total losses in various types of rotors, their degree of reaction during optimum operating conditions, the optimum entrance angle in vane-containing rotors as a function of channel diffusion properties, the behavior of vaneless diffusor stages, the maximum efficiency of the diffusors and working rotors as a function of the Reynolds number, the calculated efficiency of variously designed stages as a function of the relative width, and the calculated efficiency and the degree of pressure increase as a function of output. TAB

N69-17679# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
A PRELIMINARY STUDY OF THE AUTOMATIC SPEED CONTROL FOR THE ABORIGINE GAS TURBINE RIG
C. P. Gilbert Aug. 1968 54 p refs
(AAEC/TM-472) Avail: CFSTI

A preliminary analog study is made of the automatic speed control of a rig consisting of a non-fissile pebble bed heated by a propane-air mixture which is circulated by a gas turbine. Equations describing the system are formulated, design of a controller using frequency response methods with linearized equations is discussed.

and the behavior of a nonlinear model of the system is studied. Close agreement between the frequency response work and the analog computer results is obtained. Because a simple fuel fault could cause a serious accident, the system should not be operated without adequate thermal inertia within the pressure vessel. The analog results stress the need for an adequate bypass valve for flow control over the full range of operation of the system.
Author (NSA)

N69-17709 Florida Univ., Gainesville.
IDENTIFICATION AND CONTROL OF NONLINEAR DIFFERENTIAL SYSTEMS WITH STICTION AND COULOMB FRICTION
William Fred Acker (Ph.D. Thesis) 1967 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-9453

The object of this study is to develop theoretical techniques which will be helpful in designing a more accurate servomechanism in order to control the angular position of an output shaft so as to track a slowly moving reference position. It is assumed that motion is slow enough to excite stick-slip, nonlinear oscillations. The specific application motivating this study is the desire to build more accurate gimbal-position control systems for testing inertial-guidance components; however, the analysis and control techniques are developed and discussed from a general rather than specific point of view. The results are applicable to a wide range of problems. Using previous results, an inequality is derived which specifies the maximum positional accuracy obtainable with a particular set of plant parameters when using classical, linear, time-invariant control strategies.
Dissert. Abstr.

N69-17714# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHARACTERISTICS OF AN ELECTRIC ARC HEATER WITH TWO COOLED ELECTRODES
V. L. Sergeyev and F. B. Yurevich 15 Jan. 1968 7 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 7, no. 7, 1964 p 62-64
(AD-679807; FTD-HT-23-1308-67) Avail: CFSTI CSCL 13/1

The results of a study of the operation of an electric arc heater with two cooled electrodes are given. The volt-ampere characteristics of the heater are determined. The dependence of enthalpy and velocity as the output on power is also determined for various flow rates. The authors state that the discharge chamber described is more stable and yields greater power than a discharge chamber studied by them earlier.
TAB

N69-17765*# Westinghouse Electric Corp., Lima, Ohio.
EVALUATION OF MAGNETIC MATERIALS FOR STATIC INVERTERS AND CONVERTERS
R. M. Frost, R. E. McVay, and D. M. Pavlovic Washington NASA Feb. 1969 175 p refs
(Contract NAS3-2792)
(NASA-CR-1226) Avail: CFSTI CSCL 10B

Magnetic materials for use in static inverters and converters were tested under dc excitation and under 400 to 3200 Hz square-wave voltage excitation. Materials evaluated included: 4%Mo-79%Ni-17%Fe, 50%Ni-50%Fe, magnetically annealed 49%Co-2%V-49%Fe, singly and doubly grain-oriented silicon steel, the latter both stress-relief annealed and magnetic field annealed. Magnetization curves, hysteresis loops, core loss and apparent power were determined for temperatures from -55° to +250°C; constant current flux reset data were obtained at room ambient. The effects of both vacuum exposure at 250°C and several conventional processing steps on magnetic properties were evaluated.
Author

N69-17900 Minnesota Univ., Minneapolis.
FLUCTUATION PHENOMENA IN LOW LEVEL LIGHT DEVICES
Gerald Wayne Timm (Ph.D. Thesis) 1967 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-7396

Measurements are reported on noise in three types of low level light devices. These include transmission type secondary emission devices with a low density potassium chloride target, image intensifiers that have a phosphor photocathode sandwich as the multiplying structure, and continuous channel electron multipliers. The noise spectra for the transmission secondary emission were flat as long as they were biased at voltages below that which caused the targets to break down. The magnitude of the noise was found to be about forty to fifty percent higher than amplified input noise for the best devices with the lowest values occurring at the highest gain levels. The noise in the image intensifiers was found to be slightly higher than amplifier input noise at low frequencies and then decreased as frequency increased until shot noise of the secondary beam was reached. The reason for the noise falling with increasing frequency is that the gain is limited by the frequency response of the phosphor.
Dissert. Abstr.

N69-17903# Institut Franco-Allemand de Recherches, St. Louis (France).
CHARGER FOR SILVER-CADMIUM COLLECTOR [LADEGERAET FUER SILBER-CADMIUM-SAMMLER]
R. Pieth 4 Aug. 1967 10 p In GERMAN
(ISL-N-11/67) Avail: CFSTI

Described is a three level charge generator for silver cadmium batteries that cuts itself off when the desired supply voltage is obtained. The device encorporates a self-activating relay and is geared for charging batteries with voltage levels of 9, 9.2, and 3 volt. It keeps the corresponding charge currents constant at 50 mA, 450 mA, and 25 mA during the entire charge process.
Transl. by G.G.

N69-17943*# CARA Corp., Philadelphia, Pa.
THE RELATION BETWEEN SOLAR CELL FLIGHT PERFORMANCE DATA AND MATERIALS AND MANUFACTURING DATA Quarterly Report
S. R. Pollack [1968] 44 p
(Contract NASw-1732)
(NASA-CR-73886; QR-1) Avail: CFSTI CSCL 10B

An initial determination of seven groups of flights has been made that may be suitable for the purposes of this study. Each of these groups consists of flights that have been in orbit and transmitting for at least three months, are unclassified, and have similar space environments. Computer searches have been performed to obtain documents on silicon solar cells and on the flights in the seven groups mentioned above. Appropriate channels have been ascertained and individuals contacted to obtain data on radiation and thermal environments. These channels have been tested by requesting information on a restricted number of flights in order to determine the effectiveness and rapidity by which information can be obtained. A general coding procedure has been devised to conveniently summarize and display the availability of the information needed in this study.
Author

N69-18012*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF ENVIRONMENTAL EXPOSURE ON SILICON SOLAR CELLS
Robert Moss and Paul Berman 15 Jan. 1969 18 p refs
(Contract NAS7-100)
(NASA-CR-99338; JPL-TR-32-1382) Avail: CFSTI CSCL 10B

A series of environmental tests was performed on batches of silicon solar cells having titanium-silver contacts, with and without solder coating, to determine the effects of these environments on the mechanical and electrical properties of the cells. Cells with solder coating exhibited the largest electrical and mechanical

degradations after exposure to a series of five thermal cycles from +135 to −196°C. Cells without solder coating exhibited the largest mechanical degradations after a 36-h exposure at 145°C. This latter exposure, however, did not result in significant electrical degradation. Thus, the presence of solder coating on solar cells can have a protective or deleterious effect, depending upon the environment. It was observed that either solder-coated or non-solder-coated cells were capable of surviving all the environmental tests with essentially no degradation, indicating that problems were in the process controls rather than in the basic cell process. Analysis indicated that, in the case of solder-coated cells, the major problem was in the control of solder thickness and uniformity. In the case of non-solder-coated cells, the major problem area was not identified; however, it is postulated that more than one mechanism is operating since it was not possible to correlate electrical degradation with contact pull-strength degradation.
Author

N69-18030# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POWER RELATIONSHIPS IN A CONTACTLESS AC MACHINE OPERATING AT VARIABLE SPEED
P. A. Kyalyan [1968] 18 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Energ. (Minsk), v. 8, no. 11, 1965 p 7–14
(AD-679819; FTD-MT-24-72-68) Avail: CFSTI CSCL 10/2

A synchronous-flux machine for generating constant-frequency 3-phase power at variable speed of rotation is analyzed; it includes a special frequency changer for supplying the field-current frequency proportional to the rotor slip. The magnetic flux produced by the field current rotates with respect to the open stator winding at a synchronous speed; a stationary frequency changer supplies the field winding. This machine is theoretically regarded as a cascade of two symmetrical wound-rotor induction machines; its fundamental equations are set up, and formulas for currents, power, and torque under sustained operating conditions are derived. Distribution of the active power depending on the rotor-rpm variation, for $S > 0$, $s = 0$, $s < 0$, is analyzed. It is found that the excitation power is not lost in the machine, but rather is supplied to the line or is taken from the line. It is claimed that the above type of synchronous-flux machine can operate economically as a generator or as a motor.
TAB

N69-18042*# TRW Systems, Redondo Beach, Calif.
BATTERIES FOR SPACE POWER SYSTEMS
Paul Bauer Washington NASA 1968 314 p refs
(NASA-SP-172) Avail: CFSTI CSCL 10C

A summary of all NASA sponsored work on batteries and related electrochemistry is given. Basic processes in a galvanic cell and operational and test problems of all types of batteries are outlined and data requirements for the design of sophisticated, high-efficiency space electric-power systems are analyzed. The validity and usefulness of individual battery systems for spacecraft applications are evaluated with emphasis on battery selection and integration into high efficiency electric-power systems.
G.G.

N69-18068*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POWER SYSTEMS RESEARCH AT MSFC
Richard Acker, Richard J. Boehme, William L. Crabtree, Walter H. Goodhue, Charles B. Graff et al *In its* Res. Achievements Rev., Vol. 2 1968 68 p (See N69-18059 07-34)
Avail: CFSTI CSCL 10

A scale model was developed of a 6 V, 70 A-hr battery containing cells with the exact electrode configuration and size that will be required for the 28 V, 400 A-hr vehicle power system. A capillary matrix close-loop cell system was developed for space applications. Basic development work resulted in the fabrication of a design verification test fuel cell system for qualification on space missions. Fuel cell technology research was conducted in electrodes and electrolytes at the basic research level and in cooling systems and environmental testing at the systems' analysis level. A systems analysis and description are presented on the SNAP 29 power system. A method for predicting the amount of power available from a solar array in circular orbit and under gravity gradient stabilization is presented. A brief presentation is made of the metal arc illuminator for solar array testing. An electrical power conversion system designed for a manned earth orbital vehicle is described. A comparison is made of several typical motors used to power auxiliary equipment up to 1.5 kW; the advantages and disadvantages of each type motor are mentioned.
B.P.

N69-18287*# TRW Systems Group, Redondo Beach, Calif.
TESTING THE CSM S-BAND HIGH GAIN ANTENNA SERVO
R. J. Chan 13 Dec. 1968 39 p refs
(Contract NAS9-8166)
(NASA-CR-92498; TRW-11176-H096-R0-00) Avail: CFSTI CSCL 09E

Techniques are provided for measuring the command service module high gain antenna (CSM HGA) servo closed-loop response and the transfer function of the elevation and azimuth compensation network. Test results obtained by the techniques outlined are to be used to verify the analytic model and proper operations of the CSM HGA servo. A brief description is given of the CSM HGA servo under closed-loop operation. The objectives and methods of the antenna tests are presented. They include the type of measurements required, the equipment required, the antenna servo test setup, and the measurement steps for antenna closed-loop and servo compensation response tests. The mathematical model of the servo closed-loop and compensation networks transfer characteristics is presented. Development of the test setup error modulation circuit and the derivation of the error ratio defining the closed-loop response are included.
Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-17248*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MITOTIC SYNCHRONIZATION OF L-STRAIN FIBROBLASTS WITH 5-AMINOURACIL AS DETERMINED BY TIME-LAPSE CINEPHOTOGRAPHY
Clarence D. Cone, Jr. and Max Tongier, Jr. Washington Feb. 1969 28 p refs
(NASA-TN-D-5021) Avail: CFSTI CSCL 06A

A technique for producing mitotically synchronous cultures of L-strain fibroblasts by treatment with 5-aminouracil (an analog of thymine) is presented along with a detailed description of a procedure for determining the resulting degree of synchrony by use of time-lapse cinephotography. Several sets of representative experimental results illustrating the mitotic synchronization effectiveness of 5-aminouracil as determined by the time-lapse technique are presented and are interpreted on the basis of previous results for plant and animal cells. Basic effects on the validity of experimental results, caused by deviations of synchronized experimental cultures from ideal or perfect synchrony are also discussed, and a quantitative index for expressing the relative degree of synchrony attainable with various agents is defined.
Author

N69-17321# NOLIT Publishing House, Belgrade (Yugoslavia).
EFFECT OF POSTIRRADIATION BLEEDING ON THE PROLIFERATION OF BONE MARROW CELLS IN MICE IRRADIATED WITH 350r: AUTORADIOGRAPHIC EXAMINATION USING THYMIDINE-H-3
Debrila Kasranovic et al *In its* Bull. of the Boris Kidric Inst. of Nucl. Sci., Vol. 17, No. 1 1966 p 46-52 refs (See N69-17315 07-34)
Avail: CFSTI

The effect of bleeding and postirradiation bleeding after 350r on the proliferation erythroid, myeloid and reticular cells in the bone marrow of mice is as follows: 1. In normal animals bleeding leads to increase of labelling activity of erythroid, myeloid and reticular cells; the increase is much lower in reticular cells. 2. Postirradiation bleeding causes an earlier onset and peak of proliferation of erythroid cells in comparison with the behavior of proliferation of erythroid cells in mice only irradiated. 3. The application of the method of labelling cells (with thymidine-^{3}H) in evaluating the proliferation of myeloid elements after irradiation must be accepted with suspicion, at least if doses near semilethal are concerned, because the stopping of mitotic activity causes the appearance of atypical cells labelled with marked intensity. 4. Effect of postirradiation bleeding on the proliferative activity of reticular cells is stimulative, but spontaneous postirradiation regeneration indicated that it does not favor it. Author

N69-17322# NOLIT Publishing House, Belgrade (Yugoslavia).
INFLUENCE OF DNA ISOLATED FROM DIFFERENT ORGANS ON THE REPARATION OF GERMINAL EPITHELIUM AND MORPHOLOGICAL CHANGES OF SPERMATOZOA OF TOTAL-BODY X-IRRADIATED RATS
N. Savkovic et al *In its* Bull. of the Boris Kidric Inst. of Nucl. Sci., Vol. 17, No. 1 1966 p 53-62 refs (See N69-17315 07-34)
Avail: CFSTI

A study has been made of the effects of homologous liver, thymus, spleen, testes, brain and kidney DNAs on the reparation of germinal epithelium and morphological changes of spermatosoa of rats irradiated with a dose of 600r. The results shown that animals irradiated and treated with DNA from different organs show marked signs of reparation of spermatogenesis. They also show that DNA from different organs markedly decrease the number of morphologically abnormal spermatozoa. Author

N69-17323# NOLIT Publishing House, Belgrade (Yugoslavia).
EFFECTS OF ACTINOMYCIN-D ON THE INCORPORATION OF 6-C-14-OROTIC ACID INTO THE RIBONUCLEIC ACID FRACTIONS OF RESTING RAT LIVER
Svetozar Petrovic et al *In its* Bull. of the Boris Kidric Inst. of Nucl. Sci., Vol. 17, No. 1 1966 p 62-69 refs (See N69-17315 07-34)
Avail: CFSTI

It has been established that actinomycin-D injected into adult rats produces a significant depression of RNA labelling in nuclear and cytoplasmic RNA fractions in resting rat liver. The data obtained show that s-RNA synthesis is depressed too. Author

N69-17379# Yale Univ., New Haven, Conn.
RETINAL FINE STRUCTURE AND VISUAL ORIENTATION Final Research Report, 1 Jan.-31 Dec. 1967
Talbot H. Waterman Oct. 1968 6 p refs
(Grants AF-AFOSR-1064-66; AF-AFOSR-1064-67)
(AD-678607; AFOSR-68-2336) Avail: CFSTI CSCL 6/3

The primary objective of this research project was to determine the sensory mechanism which permits many animals including various kinds of arthropods and cephalopods to orient themselves to the e-vector of natural polarized light in the sky and under water. Author (TAB)

N69-17395*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
FROG EGG EXPERIMENTAL HARDWARE FOR APOLLO APPLICATION PROGRAM. PROTOTYPE PHASE Final Report
22 Oct. 1968 55 p
(Contract NAS2-4641)
(NASA-CR-73298) Avail: CFSTI CSCL 06S

This report describes the work effort performed in the design and development of prototype hardware for a Frog Egg Experiment for the Apollo Applications Program. The purpose of the experiment is to determine the effects of zero gravity upon fertilization and germination of frog eggs; therefore, this experiment requires fertilization of the eggs while in orbit under a zero gravity environment. The complete experiment package consists of four modules, each containing three biological units. Each biological unit consists of a series of chambers and valves that enable a complete cycle of growth from fertilization of the frog egg, through germination and preservation at a desired stage of growth. During the contract period, a breadboard unit and a prototype module were designed, fabricated and tested. The feasibility of providing experiment hardware to accomplish the desired function has been successfully demonstrated where acrylic is utilized for the chambers. Encouraging results have been achieved in using prototype glass chambers; however, breakage problems must be resolved before glass will be acceptable. Reasonable solutions to these problems are available for evaluation. Additional effort is needed in this area. Author

N69-17477# Argonne National Lab., Ill.
BIOLOGICAL AND MEDICAL RESEARCH DIVISION Annual Report, 1967
Dec. 1967 300 p refs
(Contract W-31-109-ENG-38)
(ANL-7409) Avail: CFSTI

Research activities are reported in the following areas of investigation: biophysical studies of molecular interactions, radiation effects on cultured cells, and factors affecting radiosensitivity; analysis of radiation effects on cells at the biochemical level, and the biosynthesis of macromolecules; biosynthesis and activity of enzymes in various pathways and the effects of ionizing radiation on these phenomena; preparation, detection, analysis, and effects of radioisotopes in tracer studies; investigations of biochemical activities at the ultrastructural level in cells; effects of hormones on phototropic mechanisms in plants; gravity compensation studies in irradiated and nonirradiated plants; studies in mammalian genetics and the effects of radiation of genetic patterns; microbial and mutagenesis in microbial populations; radiobiological and biochemical studies of developmental phenomena among amphibia and insects; biochemical, biophysical, and radiobiological studies of the mechanisms of carcinogenesis in organisms. NSA

N69-17523 Washington Univ., Seattle.
KINETICS OF PROTON TRANSFER IN AMINO ACIDS AND PEPTIDES
Kenneth Roy Applegate (Ph.D. Thesis) 1967 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-9259

Ultrasonic absorption measurements have been made in basic solutions of the amino acids glycine, β-alanine, γ-aminobutyric acid, L-aspartic acid, L-glutamic acid, and of the peptides diglycine and triglycine over the frequency range from 3.5 to 85 Mc/sec, and over the pH range from 9 to 13. The frequency dependence of the absorption can be explained in terms of a single relaxation process with relaxation frequencies ranging from 5.05 Mc/sec for triglycine to 56.33 Mc/sec for γ-aminobutyric acid. The associated volume change for the process lies between 18 and 38 cc/mole. The variation of attenuation with pH exhibits a characteristic maximum within the range of study for each compound. The preceding results are consistent with a rate process in which a proton is transferred between the amino group and a water molecule. Dissert. Abstr.

N69-17603# Atomic Energy Establishment, Winfrith (England).
READING EQUIPMENT FOR THERMOLUMINESCENT DOSIMETRY
K. E. G. Perry Jul. 1968 15 p refs
(AEEW-R-607) Avail: CFSTI; UK 2s 6d

A thermoluminescent reader used routinely for the measurement of finger tip doses is described. It covers a wide range of dose measurement and employs mainly commercially available electronic units in modular form. A more recent design of the measuring head, which is still under development, is suitable for use with solid forms of disc dosimeters as well as with loose LiF powder. NSA

N69-17742# Armed Forces Radiobiology Research Inst., Bethesda, Md.
VISUAL DISCRIMINATION PERFORMANCE IN THE MONKEY (MACACA MULATTA): A TECHNIQUE AND ASSESSMENT OF 5000 RADS GAMMA-NEUTRON IRRADIATION
H. J. deHaan and J. E. Germas Jun. 1968 33 p refs
(AD-679698; AFRRI-SR68-16) Avail: CFSTI CSCL 6/18

A study was undertaken to assess the effects of radiation on visual discrimination performance in the monkey (Macaca mulatta). Six monkeys were trained to avoid shock by responding to one of two visual stimuli presented simultaneously. Each monkey was irradiated with approximately 5000 rads of gamma-neutron radiation delivered in a millisecond-range pulse. Behavioral data were obtained from 1/2 hour prior to the pulse and for 2-1/2 hours afterwards (Phase 1). Thereafter, behavioral data were obtained every 4 hours from pulse time (Phase 2). Temporary decrements in visual discrimination performance occurred in five out of six monkeys after exposure (median interval = 2 minutes, 10 seconds). The duration of the decrement varied between 7-1/2 minutes and 2-1/2 hours (the duration of Phase 1). All monkeys were able to perform visual discriminations at some time after irradiation. Maximum postirradiation performance during Phase 2 sessions occurred on the average at 8 hours postpulse, but ranged from 4 to 20 hours. Survival time varied from approximately 12-1/2 hours to 51-1/2 hours. Vomiting occurred in five out of six animals, but did not appear to interfere with effective performance. The results demonstrated a marked variability in the monkeys response to radiation in both performance and survival time. Author (TAB)

N69-17764# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Radiology.
DEPARTMENT OF RADIOLOGY Annual Report for Period Ending 30 Apr. 1968
Hymar L. Friedell 1 May 1968 179 p refs
(Contract W-31-109-ENG-78)
(COO-78-174) Avail: CFSTI

The results and status of research in the Department of Radiology at Case-Western Reserve University are reported. For convenience, the reports are submitted in the following sections: radiation physics, radiation cytology, radiation biochemistry, radiation modifiers, and radiation physiology. A list of publications and reports originating in the department is included as well as a list of the meetings attended and papers presented. NSA

N69-17777*# Chicago Univ., Ill. Dept. of Biophysics.
INVESTIGATIONS IN SPACE-RELATED MOLECULAR BIOLOGY INCLUDING CONSIDERATIONS OF THE MOLECULAR ORGANIZATION IN LUSTER SOUNDING ROCKET PROGRAM Semiannual Progress Report, 1 May-31 Oct. 1968
Humberto Fernandez-Moran 31 Oct. 1968 41 p refs
(Grant NGL-14-001-012)
(NASA-CR-73888) Avail: CFSTI CSCL 06A

Submicron particles obtained during rocket sounding experiments are being analyzed by electron micrographs for their extraterrestrial origin. The newly developed 200 kV electron microscope achieves resolutions of 3.6 Å to 6 Å in crystalline lattices and of about 4 Å point to point resolutions in thick biological specimens (about 250 Å to 350 Å). A closed cycle liquid helium refrigeration system is used in connection with the described electron microscope for low temperature work on ultra structures of biological systems. Developments are also reported in instrumentation and preparation techniques for high resolution cryogenic electron microscopy; publications and supporting materials from the period May 1 through October 31, 1968, are included. G.G.

N69-17782*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OSMOTICALLY INDUCED COALESCENCE OF SARCOMA CELLS THROUGH INTERCELLULAR BRIDGES IN VITRO
Clarence D. Cone, Jr., and Max Tongier, Jr. Washington Feb. 1969 24 p refs
(NASA-TN-D-5022) Avail: CFSTI CSCL 06B

A relatively detailed description is presented of a microtechnique by which cells possessing true intercellular bridges *in vitro* can be induced to coalesce into single mono- and multinucleate giant cells. The technique consists in the carefully controlled perfusion of a cell field with a hypotonic solution, which causes osmotic swelling and thereby induces connected cells to coalesce through expansion of the connecting bridge. Details of the perfusion system and methodology are discussed, along with the system of time lapse cinemicorgraphy used for recording the coalescence process. Principal features of an alternate coalescence technique utilizing a movable micropipet are also outlined. Representative photographic sequences reproduced from time lapse film recordings are presented to illustrate the basic nature of the coalescence phenomenon for the case of L-strain fibroblasts. An interpretation of the implications of coalescence in indicating cytoplasmic continuity of intercellular bridges, and other aspects of intercellular communication at the molecular level, is included. Finally, a brief mention is made of several additional cytological applications of the osmotic swelling procedure. Author

N69-17913 Brandeis Univ., Waltham, Mass.
CONSTRUCT AND FIGURE INTEGRACTIONS WITHIN A PERSONAL CONSTRUCT SYSTEM: AN EXTENSION OF REPERTORY GRID TECHNIQUE
Jack R. Adams-Webber (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-9925

The primary concern of this study was the analysis of the ways in which structural characteristics of an individual's personal construct system influence his social judgments and predictions. The methodological paradigm employed here was based on Kelly's Repertory Grid technique. The basic assumption of this research was that each individual evolves a system of interpersonal constructs to interpret and predict his own behavior and that of his associates. A series of related hypotheses were developed within the axiomatic framework of Personal Construct Theory and subjected to experimental test. These hypotheses concerned relationships between certain structural characteristics of an S's construct system and formal aspects of his inferences about a new acquaintance following a brief social interaction with him. Dissert. Abstr.

N69-17930# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAXIMAL OXYGEN CONSUMPTION AND THE FUNCTIONAL STATE OF THE CIRCULATORY SYSTEM FOLLOWING SIMULATED WEIGHTLESSNESS
V. S. Georgiyevskiy et al 29 Mar. 1968 9 p Transl. into ENGLISH of the book "Simpozium. Povyshcheniye Ustoychivosti Kislorodnogo Rezhima Organizma i Ego Regulirovaniya" Kiev 1966
(AD-679504; FTD-HT-23-124-68) Avail: CFSTI CSCL 6/18

The effects of simulated weightlessness on oxygen consumption and the functional state of the cardiovascular system were studied in four healthy male subjects aged 22-25 yrs. Weightlessness was simulated by 20 days of rigorous bed rest (the horizontal position of the body during bed rest creating a hydrostatic pressure distribution similar to that produced by the absence of gravity). Motor activity was kept to a minimum; the subjects were aided in feeding and toilet functions by nursing personnel, and passed the time in reading, chatting, and watching TV. Before and after bed rest the subjects underwent progressive physical-loading tests consisting of work of increasing difficulty on a veloergometer. Endurance limits were considered reached when the subjects were unable to continue and when O2 consumption and pulse rates reached high levels. The amount of work performed during the test, O2 consumption and CO2 excretion, phonocardiograms, carotid sphygmograms, and EKGs were recorded. Author (TAB)

N69-18166 Columbia Univ., New York.
PARAMETERS OF VISUAL BAND MOVEMENT
Vivianne Cameron Smith (Ph.D. Thesis) 1967 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 67-15522

The velocity at which a light, rotated in a fronto-parallel plane around a foveal fixation target, appears as a filled band of light rather than a moving luminous object was determined with parametric manipulation of (a) eccentricity of the moving target, (b) arc length traversed, (c) luminance and wavelength composition of the target, and (d) visual angle subtended by the target. The velocity of threshold increases as the luminance, arga, and arc length increase. It is also possible to calculate, for each arc length, the time that the moving light remains in the field at threshold velocity. The form of the time-luminance function depends on the retinal locus, the photopic or scotopic mechanism dominating the response, and on the arc length. Dissert. Abstr.

N69-18220# Aktiebolaget Atomenergi, Stockholm (Sweden).
ASPECTS OF LOW TEMPERATURE IRRADIATION IN NEUTRON ACTIVATION ANALYSIS
D. Brune Aug. 1968 14 p refs
(AE-332) Avail: CFSTI

Neutron irradiation of the sample while frozen in a cooling device inserted in a reactor channel has been carried out in the analysis of iodine in aqueous samples as well as of mercury in biological tissue and water. For the simultaneous irradiation of a large number of aqueous solutions the samples were arranged in a suitable geometry in order to avoid mutual flux perturbation effects. The influence of the neutron temperature on the activation process has been discussed. Potential applications of the low temperature irradiation technique are outlined. Author (ESRO)

N69-18291# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
PERISTALTIC PUMPING WITH LONG WAVE LENGTHS AT LOW REYNOLDS NUMBER Summary Report
Ascher H. Shapiro, Michel Y. Jaffrin, and Steven L. Weinberg Sep. 1968 61 p refs
(Contract N00014-67-A-0204)
(AD-679180; Publ-68-5) Avail: CFSTI CSCL 20/4

Pumping by means of an infinite train of peristaltic waves is investigated under conditions for which (1) the relevant Reynolds number is small enough for inertial effects to be negligible and (2) the wavelength-diameter ratio is large enough for the pressure to be considered uniform over the cross-section. Theoretical results are presented for both plane and axi-symmetric geometries, and for amplitude ratios ranging from zero to full occlusion. For a given amplitude ratio, the theoretical pressure rise per wavelength decreases linearly with increasing time-mean flow. An experiment with a quasi-two-dimensional apparatus confirmed the theoretical values. Calculations of the detailed fluid motions reveal that under many conditions of operation the net time-mean flow is the algebraic difference between a forward time-mean flow in the core of the tube and a backward (reflux) time-mean flow near the periphery. The percentage of reflux flow can be very high. This reflux phenomenon is probably of physiologic significance in the functioning of the ureter and the gastro-intestinal system. A second fluid mechanical peculiarity with physiological implications is that of trapping: under certain conditions an internally-circulating bolus of fluid, lying about the axis, is transported with the wave speed as though it were trapped by the wave. Author (TAB)

N69-18292* Pennsylvania State Univ., University Park. Biophysics Dept.
PHYSICS OF CELLULAR SYNTHESIS, GROWTH AND DIVISION Status Report, 1 Jul.–31 Dec. 1968
E. C. Pollard Jan. 1969 16 p refs
(Grant NGR-39-009-008)
(NASA-CR-99768) Avail: CFSTI CSCL 06P

Results of continuing research are reported. Topics include: (1) bacteriophage studies in filamentous cells; (2) investigations of the structure of ribosomes of chromatoid bodies; (3) analysis of the functions of nonsense codons, those code words in the genetic code which do not specify amino acids and have been shown to cause termination of polypeptide synthesis; (4) studies of temperature effects on phage T4 and pressure effects on ribosomes and enzymes; (5) equipment and techniques for investigating the biochemistry of learning and memory; (6) tests on effects of high sugar concentrations of *E. coli*; (7) electromicroscopic and microspectrophotometric studies of cells; (8) observations of nerve-muscle relationships in insects; (9) radiobiological studies of an aqueous DNA solution; and (10) mammalian cell research, as related to modification of radiation effects and properties of cultured cell surfaces, as well as ultraviolet techniques in photobiology. Publications released during the reporting period are listed. A.C.R.

N69-18293* Naval Aerospace Medical Inst., Pensacola, Fla. Medical Center.
RESEARCH ON THE EFFECTS OF VERY STRONG MAGNETIC FIELDS AND OF MAGNETIC FIELD-FREE ENVIRONMENTS ON MAN AND ANIMALS Progress Report, 1 Nov. 1968–31 Jan. 1969
D. E. Beischer 31 Jan. 1969 4 p refs
(NASA Order R-39)
(NASA-CR-99767) Avail: CFSTI CSCL 06S

Results of continuing research are discussed. In studying the biological effects of strong magnetic fields, the following topics are summarized: (1) performance tests on a superconducting magnet for use in electrophysiological research; (2) improved measurement techniques for determining nerve excitability; (3) effects of magnetic field strength on enzyme reactions; and (4) behavior of primates in high magnetic environments, in this case using a chimpanzee. Preparations are in progress for research into the effects of completely magnetic free environments on human subjects. The status of reports and a list of publications released during the reporting period are provided. A.C.R.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-17231# Technology, Inc., San Antonio, Tex. Life Sciences Div.
EVALUATION OF THE STATE OF THE ART DEVICES FOR THE BLIND
Norma D. Miller Jun. 1968 20 p refs
(Contract PH-43-67-1437)
(PB-180246) Avail: CFSTI CSCL 9A

The total solution of artificial vision with an external image device coupled into the visual pathway is not yet within our reach. A concentrated research and development program could probably produce the image capturing portion of the device within reasonable period of time. Basic research is still needed on the means of coding the translated image for introduction into the visual apparatus. Additional research is required to develop physiologically safe procedures for introducing the coded signals into the visual pathways. Some additional research and development effort in combining television systems with currently available optical aids would provide improved vision for many with visual handicaps. Such devices would be helpful to the partially sighted who have some measure of form discrimination remaining. The results of the effort would probably be most beneficial to the school age low vision group to broaden their opportunities for gainful occupations.
Author (USGRDR)

N69-17250# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.
INSTRUCTION SYSTEMS AND ADMINISTRATIVE PROCEDURES IN NUCLEAR REACTOR PLANTS
Poval Timmermann 3 Oct. 1968 7 p
(RISO-M-809) Avail: CFSTI

Organization and instruction systems at power reactors are considered in relation to a total man-machine system. Emphasis is placed on the instruction of reactor operators in abnormal situations.
Author (NSA)

N69-17481# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
LEGIBILITY OF SEGMENTED VERSUS STANDARD NUMERALS: THE INFLUENCE OF OBSERVER'S TASK
Terrence K. Gibney Aug. 1968 29 p refs
(AD-679528; AMRL-TR-68-124) Avail: CFSTI CSCL 5/5

In many current visual display techniques, numerals are formed by a pattern of individually illuminated segments. Laboratory research has indicated, generally, that such segmented numerals are not so easy to read as standard Arabic numerals. Research results suggest that in some practical, complex tasks these laboratory differences disappear. In this series complexity of the observers task, and his freedom to control his viewing were systematically varied. As task complexity or allowable viewing time, or both, increased, measured legibility differences between segmented and Arabic numerals tended to disappear.
Author (TAB)

N69-17482# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
EVALUATION OF A COLORIMETRIC PERSONAL DOSIMETER FOR HYDRAZINE FUELS Final Report, Aug.-Dec. 1967
Eugene L. Arnold and Robert F. Rekowski Oct. 1968 29 p refs
(AD-679527; AMRL-TR-68-15) Avail: CFSTI CSCL 6/20

An evaluation of the performance of the colorimetric personal dosimeter for hydrazine fuels was conducted. The dosimeter reagent is an acid-base indicator. Volatile bases give false positive results, and acids decrease the sensitivity of the strips to hydrazines. The useful shelf life of unopened dosimeter packets is greater than 1 year. Variations in sensitivity were observed for different lots of dosimeter strips. This problem may be corrected by proper quality control. The majority of the strips were more sensitive than indicated by the manufacturers calibration. Variation in the concentration and time of exposure at a constant CT product had little effect on the darkness of the strip but considerable effect on the hue. Strips placed in a closed cabinet for 8 hours developed a slightly red color. The badge is useful primarily as a check on the continued safety of areas which have been surveyed by a qualified bioenvironmental engineer. The badge cannot be relied on to give a useful estimate of the dose received in the case of a gross overexposure. The badge is a sensitive detector for hydrazine fuels. No great dependance should be placed on the quantitative interpretation of the colors developed.
Author (TAB)

N69-17571# Aerospace Medical Div., Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
RANDOM SHAPE RECOGNITION AT BRIEF EXPOSURE DURATIONS Final Report
Herbert J. Clark Aug. 1968 16 p refs
(AD-679529; AMRL-TR-68-125) Avail: CFSTI CSCL 5/10

Two groups of subjects were tested in a forced-choice recognition test for memory of 20 random shapes having two levels of complexity and two levels of association value. One group of 23 subjects viewed each shape for 0.25 sec., and the other group of 23 subjects viewed each shape for 0.50 sec. Fewer errors of recognition were made for shapes of high association value than for shapes of low association value while the effects of complexity and exposure duration were statistically insignificant. Consideration of the characteristics of the distractor shapes paired with the observed shapes during the forced-choice recognition test suggested that they may also have influenced recognition accuracy.
Author (TAB)

N69-17590# New York Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
SEQUENTIAL INFORMATION PROCESSING IN MAN Final Technical Report, 1 May 1967-31 Dec. 1968
Mark S. Mayzner Dec. 1968 7 p refs
(Contract N00014-67-A-0467-0001)
(AD-679913) Avail: CFSTI CSCL 5/10

A program of research has been pursued which was directed at a systematic examination of several display parameters and their effects on visual information processing in man, employing a computer-based cathode-ray tube (CRT) display system.
Author (TAB)

N69-17591# George Washington Univ., Alexandria, Va. Human Resources Research Office.
SUPPLEMENTARY FEEDBACK: AN EXPLANATION AND EXPERIMENTAL TEST
Elmo E. Miller, Richard W. Sheldon, and John F. Bjorklund Nov. 1968 20 p refs
(Contract DA-44-188-ORO-2)
(AD-679919; HumPRO-TR-68-13) Avail: CFSTI CSCL 5/10

An experiment using the pursuit rotor apparatus tested two hypotheses: (a) supplementary feedback aids learning when it provides information by which to distinguish long target contacts from short ones; (b) supplementary feedback, especially if immediate, facilitates performance by providing secondary reinforcement. Five groups, of 20 subjects each, were given 60 trials, with the criterion interval adjusted for every trial to reinforce a particular proportion of target contacts for each group.
Author (TAB)

N69-17609# Melpar, Inc., Falls Church, Va.
SYNTHETIC FLIGHT TRAINING SYSTEM AH-56/CH-47, CONCEPT FORMULATION REPORT (ADDENDUM)
Franklin E. Young and Eugene R. Hall Orlando, Fla. Naval Training Device Center Sep. 1968 72 p ref
(Contract N61339-68-C-0107)
(AD-678651; NAVTRADEVCEN-68-C-0107-2; REPT-7596) Avail: CFSTI CSCL 1/3

The report amends the Concept Formulation Report, Synthetic Flight Training System (2B24), to cover research and investigation into the technical and economic feasibility of operating one AH-56 cockpit and one CH-47 cockpit from the SFTS field unit computer/interface system. Computer storage, timing, and iteration rates, interface requirements, and instructor functions are analyzed. Required modifications of the basic-design field unit to accommodate the CH-47A/AH-56 configuration are presented. Cost and scheduling are developed for expanding one of the eight basic-design field units to include all hardware and software required for the AH-56/CH-47 simulation. The cost effectiveness of the expanded unit is analyzed. Author (TAB)

N69-17738*# Michigan Univ., Ann Arbor.
A FUNDAMENTAL STUDY OF PREDICTIVE DISPLAY SYSTEMS
John De Shon Warner Washington NASA Feb. 1969 200 p refs
(Contract NASr-54(06))
(NASA-CR-1274) Avail: CFSTI CSCL 05H

The particular predictive technique considered utilizes a repetitive, fast time, on-line computation scheme which provides a predicted response of the controlled element to the human operator based on certain assumptions about future control inputs and disturbances. An in depth discussion is provided on the various characteristics that are important in any predictive display application. The problem of performance measurement is discussed. An experimental investigation on the effects of the controlled element dynamics on performance with three display forms (exploratory prediction, on-line prediction, and no prediction) in a time vs. error format is reported. A minimum time terminal control task for a pure inertia system driven by a fixed three state relay controller was chosen for the study. The system is described by several independent parameters which are hypothesized as being important in a variety of manual control situations. These parameters are varied systematically to determine their effect on performance with the three display forms. Several new performance measures are developed for use in minimum-time terminal control tasks. Author

N69-17814*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
HUMAN TRANSFER CHARACTERISTICS IN FLIGHT AND GROUND SIMULATION FOR A ROLL TRACKING TASK
Fred D. Newell (Cornell Aeron. Lab., Inc.) and Harriet J. Smith
(NASA-TN-D-5007) Avail: CFSTI CSCL 05H

Pilot transfer characteristics for three pilots were measured in flight and in ground based simulators for a compensatory roll tracking task with small bank angle disturbances. The forcing function, in each case, consisted of the sum of ten sine waves with a bandwidth of 1.5 radians per second. A variable stability T-33 airplane was used to obtain the flight measurements. Ground based simulator measurements were obtained with both the T-33 airplane and a general purpose simulator which used a contact analog color display. Three different controlled elements were used, two of which were simple single degree of freedom controlled elements that were studied previously. The third was a multiple degree of freedom element representative of an airplane with good handling qualities and was considered and controlled as a single degree of freedom configuration in roll. The results of the simple controlled element experiments agreed reasonably well with previous results. For the multiple degree of freedom controlled element experiment, a noticeable effect of display was found. For this experiment, which was restricted to a small disturbance bank angle tracking task with good controlled element dynamics, nonvisual motion cues appeared to be of less importance than visual cues. Author

N69-17849# P. E. C. Research Associates, Inc., Louisville, Ky.
LOGIC OF DISCOVERY Final Report, 10 Jan. 1968-30 Jul. 1968
Michael Scriven Jul. 1968 67 p
(Contract AF 49(638)-1672)
(AD-679605; AFOSR-68-2798) Avail: CFSTI CSCL 5/6

This report summarizes some of the reconceptualizations of the task of philosophy of science. It attempts to demonstrate the value of bringing elements from the field of discovery into the analysis of the basic concepts of completed science and the enrichment resulting from unification of subjective and objective elements in science. The report contends that there is a set of teachable procedures that can be described as the logic of science that can increase the efficiency of scientific practice and accelerate the teaching of scientific methods. The reconceptualizations are particularly relevant to research designs and strategies and to the field of computer simulation of machines having human intelligence capabilities. Author (TAB)

N69-17941* TRW Systems, Redondo Beach, Calif. Thermophysics Section Lab.
MEASUREMENTS REPORT: THERMAL PROPERTY MEASUREMENTS OF MANNED SPACECRAFT CENTER SPACESUIT MATERIALS
16 Dec. 1968 4 p refs
(Contract NAS9-3670)
(NASA-CR-92480; TRW-68-3346.11je-102) Avail: CFSTI CSCL 06K

The near normal solar reflectance and transmittance of polysulfane (with a LEV 32 coating on the rear surface) have been measured by integrating sphere reflectometer. Simultaneous reflectance and transmittance measurements were integrated over the Johnson solar energy spectrum. Transmittance was measured next, integrated over the Johnson solar energy spectrum, and then subtracted from the combined reflectance/transmittance to yield solar reflectance data of 0.14_5 for the above described material. G.G.

N69-18014# Aeronautical Research Labs., Melbourne (Australia).
PADDING MATERIALS FOR HEAD IMPACT PROTECTION
S. R. Sarrailhe Jul. 1968 35 p refs
(ARL/SM-321) Avail: CFSTI

Data on the tolerance of the head to impact are reviewed and design forces for padding suggested. The effects of padding thickness and material properties are discussed and ways of selecting materials are indicated. Results of tests on materials available in Australia are discussed. Author

N69-18046# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
PLANETARY QUARANTINE PROGRAM Quarterly Report for Period Ending 31 Dec. 1968
Dec. 1968 23 p
(NASA Orders R-09-019-040 H-13245A)
(NASA-CR-99345; QR-11) Avail: CFSTI CSCL 06B

Information on clean packaging materials was reviewed and assembled into standard handbook format. Models for estimating spacecraft bioburdens were developed for use in areas associated with manned lunar missions. A recirculating downflow unit was developed and tested for wash efficiency with aluminum oxide particles. Possible effects of lunar contamination by terrestrial organisms from Apollo systems impacting on lunar surface were estimated as well as the likelihood of retrieving any organism during the following Apollo mission. Sterilization modeling and support experimentation for generating bioengineering parameters of planetary quarantine sterilization continued. Based upon model predictions, heating at reduced levels for five to ten days evolved as effective spacecraft sterilization method. G.G.

N69-18085*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Dept. of Aerospace Medicine and Bioastronautics.
REVIEW OF PHYSIOLOGICAL MEASUREMENT TECHNIQUES FOR APPLICABILITY TO SPACE FLIGHT CONDITIONS
T. M. Fraser Washington NASA Feb. 1969 256 p refs
(Contract NASr-115)
(NASA-CR-1277) Avail: CFSTI CSCL 06B

Techniques in the fields of cardiovascular and respiratory function are examined, and approaches to anthropometric and body composition are discussed with a view toward those techniques which might be most useful in work to be performed in a manned space laboratory. Rather than claiming to be a comprehensive physiological review, this study emphasizes areas where the information to be gained is significant but where techniques available do not readily lend themselves to use in space, or where a multitude of available techniques requires consideration. K.W.

N69-18131*# Harding Coll., Searcy, Ark.
METHODS OF ACHIEVING AND MAINTAINING PHYSICAL FITNESS FOR PROLONGED SPACE FLIGHT Progress Report, 1 Jan.–31 May 1968
Henry D. Olree Jul. 1968 27 p refs
(Grant NGR-04-002-004)
(NASA-CR-99348) Avail: CFSTI CSCL 06N

Tests were conducted to determine which of three variable length training sessions, 20, 40, or 60 minutes per day, would produce the greatest gain in physical fitness. The subjects were 20 male college students, average age 21.37 years, who had below average maximal oxygen uptake values. Baselines were determined on biochemical and physiological parameters by administering the following: (1) a medical examination; (2) a lean body mass determination; (3) an American Association for Health, Physical Education and Recreation battery test; (4) a treadmill test; (5) a bicycle ergometer test; (6) an orthostatic tolerance test. Fifty-two variables were considered as indexes of physical fitness. The subjects who exercised 60 minutes per day made greater gains on specified component of physical fitness than those in the other two groups. K.W.

N69-18234# Rand Corp., Santa Monica, Calif.
SOME COMMENTS ON THE CLOSED CIRCUIT TV SYSTEM FOR THE VISUALLY HANDICAPPED
Samuel M. Genesky Dec. 1968 17 p Presented at the Ann. Meeting of the Am. Acad. of Optometry (48th), Beverly Hills, Calif., 10 Dec. 1968
(AD-679526; P-3984) Avail: CFSTI CSCL 17/2

The conventional definitions of blindness are discussed, and the term visually handicapped is used to identify persons who have poor vision and have great difficulty reading and writing even with the aid of eyeglasses. The possibility is discussed of using closed circuit television to increase image magnification, light intensity or brightness, or some combination of these factors. Details are given on a prototype system and the method of operation. M.G.J.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-17206# Tuskegee Inst., Ala. School of Engineering.
DENSITY DETERMINATIONS USING A GAMMA RADIATION ATTENUATION TECHNIQUE Annual Progress Report, 1 Jan.–31 Aug. 1967
I. G. Dillon 30 Sep. 1968 18 p refs
(Contract AT(04-1)-3604)
(ORO-3604-3; APR-2) Avail: CFSTI

A review is given of activities and accomplishments, in 1967, on a program to develop a method for determining densities of coexisting vapor and liquid phases of alkali metals by use of gamma irradiation attenuation techniques. NSA

N69-17256# Institut Franco-Allemand de Recherches, St. Louis (France).
MASS SPECTROMETRIC ANALYSIS OF EXPLOSIVE MATERIALS, PARTICULARLY DETERMINING THEIR CHARACTERISTIC SPECTRA, PART 1 [MASSENSPEKTROMETRISCHE UNTERSUCHUNGEN AN EXPLOSIVSTOFFEN, INSBESONDERE BESTIMMUNG IHRER CHARAKTERISTISCHEN SPEKTREN, TEIL 1]
F. Daeublin 25 Jul. 1967 85 p refs In GERMAN
(ISL-T-31/67) Avail: CFSTI

A modified mass spectrometer was used to determine characteristic spectra of benzene, nitrobenzene, ethylbenzene, and toluene and to measure the mass spectra of o-nitrotoluene, p-nitrotoluene, dinitrotoluene, and trinitrotoluene as a function of evaporation temperature. Possible molecular decay processes were determined and their structural formulas discussed. Results showed that substantial ion density developed always 17 mass units below molecular ion peaks. Transl. by G.G.

N69-17265 Pittsburgh Univ., Pa.
MAGNETIC CHARACTERISTICS OF LAVES PHASES CONTAINING TWO LANTHANIDE METALS WITH ALUMINUM
Wayne Martin Swift (Ph.D. Thesis) 1967 95 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-8331

The magnetic properties of several $Ln_x\ Ln'_{1-x}\ Al_2$ systems, where Ln and Ln' are two different lanthanide metals and x was usually 0.0, 0.2, 0.4, 0.6, 0.8 and 1.0 were studied. The structural and magnetic data between 4.2°K and 300°K are reported and discussed in detail, with emphasis on the nature of the magnetic coupling mode below the transition temperature from paramagnetism to cooperative behavior. The samples were prepared mainly by levitation melting under a pure Argon atmosphere. The X-ray investigations revealed that all the compounds formed the $MgCu_2$ structure (cubic Laves phase). Saturation moments were determined by a Honda plot (magnetization varying linearly with the reciprocal of the effective field). All of the compounds investigated exhibited Curie–Weiss behavior in the paramagnetic region. Furthermore, the effective moments determined in this region were in all cases in good agreement with the $g\sqrt{J(J+1)}$ values for the free ions. These data support the use of J as a good quantum number for the lanthanides. Dissert. Abstr.

N69-17281# Union Carbide Nuclear Co., Oak Ridge, Tenn.
ISOTOPE ANALYSIS OF URANIUM HEXAFLUORIDE WITH A HIGH U-235 ENRICHMENT
Louis Chaussy et al [1968] 45 p refs Transl. into ENGLISH from CEA Rept. CEA-R-3337, Mar. 1968
(K-Trans-44; CEA-R-3337) Avail: CFSTI

Isotopic analysis of uranium in the form of the hexafluoride by mass spectrometry gives gross results that are not very accurate. Using a linear interpolation method applied to two standards it is possible to correct for this inaccuracy as long as the isotopic concentrations are less than about 10% in ^{235}U. Above this level, the interpolation formula overestimates the results, especially if the enrichment of the analyzed samples is higher than 1.3 with respect to the standards. A formula is proposed for correcting the

interpolation equation and for extending its field of application to high enrichment values and to high concentrations. By using this correction the results have an accuracy that depends on that of the standards, taking into account the dispersion in the measurements.
Author (NSA)

N69-17284# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorbauelemente.
SENSITIVE ELECTRICAL DIRECT DETERMINATION OF OXYGEN IN GASES AND LIQUID METALS APPLICABLE TO TECHNICAL USE AT HIGH TEMPERATURES [EMPFINDLICHE ELEKTRISCHE DIREKTBESTIMMUNG VON SAUERSTOFF IN GASEN UND FLUESSIGEN METALLEN ZUR TECHNISCHEN ANWENDUNG BEI HOEHEREN TEMPERATUREN]
H. Sundermann and H. Wagner Sep. 1968 38 p refs In GERMAN
(KFK-819) Avail: CFSTI

A direct electric measuring method was developed for determination of oxygen in gases and liquid metals. A measuring probe for laboratory use was designed. The reliability of the method was tested in various media for possible use in reactor circuits.
NSA

N69-17295# Institut Franco-Allemand de Recherches, St. Louis (France).
TEMPERATURE DETERMINATION FROM AN AlO BAND SPECTRUM [TEMPERATURBESTIMMUNG AUS EINEM BANDENGRUPPENSPEKTRUM VON AlO]
H. Mach 3 Oct. 1967 44 p refs In GERMAN
(ISL-7/67) Avail: CFSTI

Molecular temperature of aluminum oxide spectrum bands were determined by calculating line intensities as functions of oscillating temperature. A correlation was found between spectral line intensities and intensity distributions and the temperature oscillations. The superimposition of rotational line intensities of all spectral bands together with the known oscillating temperature was then used to determine the rotational temperature.
Transl. by G.G.

N69-17306 Ohio State Univ., Columbus.
THE PHASE SEPARATION CURVE AND MOLAR DENSITY OF DILUTE He 3/He 4 MIXTURES
Edward Milton Ifft (Ph.D. Thesis) 1967 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8840

The phase separation curve and molar density at saturated vapor pressure have been measured for seven different dilute solutions of He^3 dissolved in He^4. The solutions, varying in concentration from 3.92% to 15.38%, were studied in the temperature range 0.024°K to 1.25°K. The data were obtained from measurements of the capacitance of a small 5 pF parallel-plate capacitor immersed in the lower portion of the liquid. The nylon sample cell contained about 2.0 cm^3 of helium mixture and 2.6 gm of cerium magnesium nitrate used as a thermometer. The capacitance was measured with a General Radio 1615A bridge to a precision of 1×10^{-5} pF. The method is a determination of number density, since this quantity is a function of the dielectric constant of the solution. A knowledge of the number density determines the He^3 concentration X.
Dissert. Abstr.

N69-17316# NOLIT Publishing House, Belgrade (Yugoslavia).
PROTONIZATION OF THE ARSENAZO III REAGENT IN CONCENTRATED SOLUTIONS OF PERCHLORIC AND SULFURIC ACID
Aurora A. Muk et al *In its* Bull. of the Boris Kidric Inst. of Nucl. Sci., Vol. 17, No. 1 1966 p 1-8 refs (See N69-17315 07-34)
Avail: CFSTI

Protonization of arsenazo III in concentrated solutions of perchloric and sulfuric acid has been studied. For $K = HB/B.H$, the value $\log K = -(5.04 \pm 0.06)$ was obtained. The maximum absorption of the protonized form at $\lambda_{max} = 665$ mμ can be explained by the formation of a six-membered quasi-ring by means of hydrogen bonds.
Author

N69-17317# NOLIT Publishing House, Belgrade (Yugoslavia).
REACTION OF THE ARSENAZO III REAGENT AND ZIRCONIUM IN SOLUTIONS OF CONCENTRATED PERCHLORIC ACID
Aurora A. Muk et al *In its* Bull. of the Boris Kidric Inst. of Nucl. Sci., Vol. 17, No. 1 1966 p 9-16 refs (See N69-17315 07-34)
Avail: CFSTI

The conditions of complexing of arsenazo III (Az III) and zirconium in solutions of perchloric acid have been investigated. Two complexes are formed as a function of concentration: in 2N $HClO_4$ a complex of the mole ratio Zr: Az III = 1:2, molar absorptivity $2.8 \cdot 10^4$, at absorption maximum 665 μ, and in 7N acid a complex Zr: Az III = 1:4 of molar absorptivity $1.48 \cdot 10^5$, at 665 μ.
Author

N69-17319# NOLIT Publishing House, Belgrade (Yugoslavia).
SYNTHESIS OF MALATHION LABELLED WITH S-35 OR P-32 AND DIPTEREX-P-32
Vojislav Jezdic et al *In its* Bull. of the Boris Kidric Inst. of Nucl. Sci., Vol. 17, No. 1 1966 p 28-36 refs (See N69-17315 07-34)
Avail: CFSTI

Malathion and dipterex are two of the group of organo-phosphorus compounds which are widely applied in agriculture as insecticides. In order to study the effect of malathion and dipterex as insecticides. In order to study the effect of malathion and dipterex as insecticides methods have been worked out for their synthesis with incorporated radioactive isotopes ^{32}P and ^{35}S. The syntheses described in this paper are simple and give greater yields than those previously reported.
Author

N69-17324 Delaware Univ., Newark.
THE THERMAL CONDUCTIVITY OF CARBON DIOXIDE-NITROGEN SYSTEM
Bernhard Josef Kraus (Ph.D. Thesis) 1966 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-9603

A dynamic method was used to determine the thermal conductivities and Prandtl numbers of the carbon dioxide-nitrogen system in the temperature range 925° to 1350°K and at one atmosphere. For pure carbon dioxide, an empirical Eucken factor, relating thermal conductivity and viscosity, as well as the analogous quantity, relating thermal conductivity and self diffusivity, are determined as functions of temperature by smoothing all available data on the range 200° to 1350°K. A mathematical model for treating the measured data for the mixtures was derived. Through use of this model, the Prandtl number is obtained for three different mixtures of carbon dioxide and nitrogen, having compositions of 13.9%, 30.9% and 49.8% nitrogen respectively. The temperature range covered for the mixtures was from about 980°K to 1270°K, which extended the temperature range of available data by 25%.
Dissert. Abstr.

N69-17351# Bureau of Mines, Washington, D. C.
HELIUM-4 EXPERIMENTAL PVT REFERENCES: 1895 TO 1968

Robert E. Barieau Aug. 1968 28 p refs
(PB-180205; BM-IC-8388) Avail: CFSTI CSCL 07D

A list of 163 references to original experimental PVT data on helium is presented for the period 1895 to 1988. The list is complete as of the start of the Helium Centennial Year, 1968, to the best of the author's knowledge. Author (USGRDR)

N69-17363# California Univ., Riverside. Dept. of Chemistry.
NOVEL SIGMA-BONDED TRANSITION METAL CARBORANE COMPLEXES
James C. Smart, Philip M. Garrett, and M. Frederick Hawthorne Nov. 1968 9 p
(Contract N00014-67-A-0353)
(AD-679765; TR-9) Avail: CFSTI CSCL 7/2

Reactions of 1,2-B10C2H11(-) and 1,10-B8C2H8(-2) ions with ((Pi-C5H5)Fe(CO2))2 in ether solvents produces sigma-bonded iron carborane complexes. The two complexes reported are 1-((Pi-C5H5) Fe(CO2)-2-(CH3)-sigma-1, 2-B10C2H10)) and 1, 10-((Pi-C5H5) Fe(CO)2)2 - 1, 10-(sigma-B8C2H8) which were prepared in 47 and 71% yield, respectively. Author (TAB)

N69-17376 Michigan Univ., Ann Arbor.
DENSITY MEASUREMENTS FOR NEON AT LOW TEMPERATURES
Leon Rouzelle Scott (Ph. D. Thesis) 1967 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-7721

The density of pure neon was measured at 154 points over the range from 28°K to 70°K for pressures up to 240 atmospheres. These data were taken in such a way that 19 isochores comprising 15 isothermal lines were generated. The data thus fill the gap in previously published data around the vapor dome and near the critical point. These are the only experimental data available around the vapor dome and in the compressed liquid region for neon. The data were obtained using a constant volume system which was constructed for this purpose. The test cell in which measurements were made was within an evacuated chamber in a liquid hydrogen bath. The cell was electrically heated for temperature control. The pressures were measured with a dead weight gage. The majority of the resultant data from these measurements is within an estimated 0.2% of the true values, based on an error analysis of the system and equations used. Dissert. Abstr.

N69-17384 West Virginia Univ., Morgantown.
THE CONDUCTION ELECTRON SPIN SUSCEPTIBILITY OF LITHIUM AND LITHIUM-MAGESIUM ALLOYS
James Edward Kettler (Ph.D. Thesis) 1967 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8343

Measurements of the conduction electron spin susceptibility of lithium at 4.2°K and of lithium containing small amounts of magnesium at room temperature have been made using a spin resonance technique. The nuclear spin-lattice relaxation time, T_1, at 4.2°K has also been measured for lithium and the dilute lithium-magnesium alloys by a direct method. The results indicate no significant difference in the value of T_1 for lithium and for alloy samples containing up to 8.24 at. % magnesium. The $T_1T = 44 \pm 2$ sec°K relation was not attained by the present measurements due to the presence of impurities. The relation $T_1T = 40$ sec°K was more closely satisfied by our results for lithium and the alloys. The susceptibility measurements do indicate a slight decrease upon alloying magnesium with lithium. The decrease is on the order of 5% for samples containing less than 0.1 at. % magnesium. This is a larger decrease than would be expected from a comparison with the modified Korringa relation or with experimental results on the specific heat and the Knight shift. The measurement could not be extended to higher concentrations because the electron resonance line width increases rapidly with magnesium content and cannot be observed at the low fields dictated by the conditions of the experiment. Dissert. Abstr.

N69-17390# Boeing Scientific Research Labs., Seattle, Wash.
THERMAL DESORPTION OF CARBON MONOXIDE FROM COPPER
Alan W. Smith Oct. 1968 18 p refs
(AD-677568; D1-82-0760) Avail: CFSTI: CSCL 7/4

The thermal desorption of carbon monoxide adsorbed on copper has been studied. After ion bombardment cleaning, two thermal desorption peaks were observed. They followed second order kinetics, and had activation energies of 14.7 and 16 Kcal/mole. The pre-exponential factors were 3 x 10 to the 11th power and 5 x 10 to the 7th power/second. After annealing, the high temperature peak was absent unless the sample was exposed to a much greater amount of carbon monoxide. There was very little shift in the position of the low temperature peak with initial coverage. This suggests that the apparent second order peak is made up of states with first order kinetics but with differing activation entropies for desorption. Samples cleaned by oxidation followed by reduction gave similar results except that a definite shift of the peak with initial coverage was observed. Author (TAB)

N69-17404# McGill Univ., Montreal (Quebec). Dept. of Chemistry.
A RELATION BETWEEN THE RELAXATION MECHANISM AND THE DISTRIBUTION OF RELAXATION TIMES
A. Eisenberg and L. A. Teter Aug. 1968 12 p refs
(Contract N00014-68-C-0237)
(AD-679903; TR-18) Avail: CFSTI CSCL 7/4

It was found that materials which relax by bond interchange in the glass transition region exhibit a much narrower distribution of relaxation times than those which relax by molecular flow. The half-width of the distribution is defined. Materials which relax by bond interchange have half-width values below ca 0.8, whereas those relaxing by molecular flow have values above ca 1.0. The correlation represents a useful diagnostic tool for the simple identification of the relaxation mechanism in polymers. Author (TAB)

N69-17405# Aerospace Corp., El Segundo, Calif. Lab. Operations.
LOW ENERGY ELECTRON DIFFRACTION STUDIES OF THE INTERACTION OF OXYGEN WITH A MOLYBDENUM (100) SURFACE Research Document, Jun. 1967-Jun. 1968
S. Feuerstein and H. K. A. Kan Sep. 1968 22 p refs
(Contract F04701-68-C-0200)
(AD-679976; TR-0200(4250-20)-5; SAMSO-TR-68-429) Avail: CFSTI CSCL 7/4

Oxygen adsorption on the (100) surface of molybdenum single crystals was examined by low-energy electron diffraction (LEED) in a display-type apparatus. Continuous diffraction pattern observations from an initially clean surface were made at reaction temperatures between room temperature and 850C degrees. Below 650C degrees, no new ordered structures were observed. At 750C degrees, four ordered structures were formed on the surface with increasing oxygen coverage. The thermal characteristics and kinetics of formation of these oxides are discussed. In addition, models of surface structure with less than a monolayer oxygen coverage are presented. Author (TAB)

N69-17413# Princeton Univ., N. J. Dept. of Chemistry.
RESEARCH ON DIELECTRICITY Final Report, 1 Sep. 1966-30 Jun. 1968
Charles P. Smyth Jun. 1968 10 p refs
(Contract N00014-67-C-0151-0002)
(AD-679941) Avail: CFSTI CSCL 7/4

Measurements of dielectric constant and loss at frequencies extending to those of millimeter waves were carried out and used to calculate molecular and intramolecular relaxation times. Siloxanes and metal acetylacetonates were found to absorb dielectrically by group rotation, twisting, bending, or inversion. Rotational oscillations in several other molecules were found to contribute to the infrared absorption, but not to the dielectric absorption. The effects of hydrogen bonding upon the dielectric relaxation times of solutions of water, alcohols, and chloroethanes were used to study structures and strengths of bonding. The existence of an absorption region in non-polar liquids extending from the microwave to the very-far infrared region was confirmed and quantitatively explained in terms of induced dipole moments. Author (TAB)

N69-17425 Rochester Univ., N. Y.
QUANTUM DYNAMICS OF THE MORSE OSCILLATOR
Paul F. Endres 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-9371

The dynamics of a simple quantum Morse oscillator with a Gaussian initial wave packet has been evaluated using the quantum variational method, second order perturbation theory, and the exact Morse eigenfunctions. A method of evaluating matrix elements of the Hamiltonian has also been examined. The evolution of an analogous classicial ensemble of Morse oscillators has been evaluated and compared with the quantum results. A brief discussion relating the calculations to unimolecular chemical kinetics is included. An appendix contains FORTRAN II listings of all computer programs used in this work. Dissert. Abstr.

N69-17442 Illinois Univ., Urbana.
APPLICATION OF THE AUGER PROCESS TO THE STUDY OF GASEOUS ADSORPTION ON TUNGSTEN
Gary George Tibbetts (Ph.D. Thesis) 1967 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-8246

Apparatus is described which allows the density of gas adsorbed on metal surfaces to be monitored by observing changes in the number of electrons ejected from the surface by a constant current, low energy ion beam. It is shown that the electron emission process (an Auger process) is temperature independent; thus, surface coverages may be easily compared at different temperatures. Adsorption at room temperature and at the temperature of liquid nitrogen was studied by flash filament and Auger techniques. Desorption kinetics of H_2, CO, and N_2 from polycrystalline, (110), and (111) tungsten foils are discussed. These gases are not absorbed with a few unique binding energies, but they are bound to the surface with a distribution of binding energies. It is shown that desorption at constant temperature from such a distribution of states can be easily distinguished from desorption with a unique binding energy. However, the determination of the order of the desorption process is substantially more difficult. Calculations are presented which illustrate these points. Dissert. Abstr.

N69-17483# Argonne National Lab., Ill.
THE INVESTIGATION OF TRANSPLUTONIUM ELEMENTS: RESULTS, PROBLEMS, AND POSSIBILITIES [DIE UNTERSUCHUNG VON TRANSPLUTONIUMELEMENTEN. ERGEBNISSE PROBLEME UND MOEGLICHKEITEN]
W. Mueller Sep. 1968 59 p refs Transl. into ENGLISH from the German rept. EUR-3893
(ANL-Trans-676; EUR-3893) Avail: CFSTI

The preparation, some properties, and possible applications of transplutonium elements available in gram and multigram amounts, are described. Scientific and practical problems associated with the investigation of these elements or their compounds are discussed. Author (NSA)

N69-17489# California Univ., Berkeley. Lawrence Radiation Lab.
ATOMIC BEAM MEASUREMENT OF THE ISOTOPE SHIFTS IN Cs 127, Cs 129, Cs 133, Cs 134, Cs 134m, and Cs 137
Edmond Chen-ching Wang (Ph.D. Thesis) 27 Sep. 1968 72 p refs
(Contract W-7405-ENG-48)
(UCRL-18434) Avail: CFSTI

A new atomic-beam technique has been employed to measure the isotope shifts of five radioactive cesium isotopes relative to the stable isotope ^{133}Cs. The shifts (in 10^{-3} cm^{-1}) in the D_1 line are found for ^{127}Cs, ^{129}Cs, ^{134}Cs, ^{134m}Cs, ^{137}Cs, to be +5.9(1.5), +2.8(1.5), +1.8(1.0), −2.2(1.2), −6.0(1.5), respectively. Here a positive sign means that the wave number of the D_1 line for the indicated isotope is greater than that for ^{133}Cs. The normal volume shift is calculated to be 10.7×10^{-3} cm^{-1} for the addition of one neutron. There is evidence that points to the cancellation of the normal volume effect by the deformation effect as a possible explanation of the smallness of the observed shifts. Author (NSA)

N69-17516 Florida Univ., Gainesville.
TWO STUDIES IN PHOSPHORIMETRY: 1. SIGNAL-TO-NOISE EXPRESSIONS. 2. TIME-RESOLUTION OF PHOSPHORESCENCE
Peter Alan St. John (Ph.D. Thesis) 1967 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-9486

Equations for the luminescence signal and the noise signals normally encountered in molecular luminescence spectrometry are derived. These equations are used to predict limiting detectable concentrations for several organic compounds by fluorescence and phosphorescence analysis and to predict the shape of analytical curves. Use of the signal to noise ratio equation for the optimization of experimental parameters is illustrated. A comparison of calculated and experimentally determined limiting detectable concentrations is presented. A new method for the analysis of two component mixtures of organic phosphors is presented. The method, which is based on differences in phosphorescence decay times, is called time resolved phosphorimetry. The emission intensity due to each component n a mixture is determined from a plot of h the logarithm of relative emission intensity versus time. Dissert. Abstr.

N69-17595# Tyco Labs., Inc., Waltham, Mass.
CHEMISORPTION OF NITROGEN AND CARBON DIOXIDE ON NICKEL AND PLATINUM Scientific Interim Report
Edwin Rissmann and Raymond Jasinski Sep. 1968 28 p refs
(Contract AF 19(628)-5549)
(AD-679752; AFCRL-68-0492; SR-2) Avail: CFSTI CSCL 7/4

Nitrogen at -196C and CO2 at 25C chemisorb on nickel and platinum. The extent of this chemisorption is variable, depending sensitively on the pretreatment of the surface. The extent of N2 chemisorption can, in some cases, invalidate BET surface area measurements made with this gas. A constant ratio of 2.5/1 exists on nickel and on platinum, between the volume of CO2 chemisorbed at 25C to the volume of N2 chemisorbed at -195C. Prior CO2 adsorption inhibits the chemisorption of N2, implying a direct relationship between the N2 sites and the CO2 sites. Author (TAB)

N69-17599# Argonne National Lab., Ill.
INVESTIGATION OF THE DENSITY OF LIQUID Pb, Cs, AND Ga, BY THE GAMMA METHOD
A. S. Basin and A. N. Solov'ev [1968] 9 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Techn. Fiz. (Moscow), no. 6, 1967 p 83-87
(ANL-Trans-677) Avail: CFSTI

The density of liquid metals was studied using a noncontact gamma method based on penetrating radiation attenuation by the substance. Descriptions are given of the installation used for studying the density of liquid lead, cesium, and gallium. The tabulated results obtained describe the density of liquid lead by the equation: $\rho_l(Pb) = 10.679$ to 12.887×10^{-4} (T - 600.6) g/cm^3 with the mean square deviation ± 0.16% with a maximum error of ≈0.4% for a single measurement at 1320°K; for liquid cesium: $\rho_l(Ca) = 1.8390$ to 5.665×10^{-4} (T - 301.4) g/cm^3 with the mean square deviation of 0.23%, and maximum error of 0.7% at 1120°K; and, for liquid gallium at 1020 to 1400°K $\rho_l(Ga) = 5.63464$ to 5.127×10^{-4} (T - 1020) g/cm^3 with mean square deviation of 0.05% and maximum error of 0.25% at 1400°K.
NSA

N69-17600# Aktiebolaget Atomenergi, Stockholm (Sweden).
APPLICATION OF A BETATRON IN PHOTONUCLEAR ACTIVATION ANALYSIS
D. Brune, S. Mattsson, and K. Liden Aug. 1968 13 p refs
(AE-333) Avail: CFSTI

The present study concerns the determination of fluorine, iodine, lead and mercury by means of photonuclear activation technique using a betatron. The detection limit obtained for the elements in the above given sequence amounted to 3, 50, 400 and 15 μg respectively. The technique was applied in the determination of iodine in pharmaceuticals. A rotating sample holder device was inserted in the bremsstrahlung beam of the betatron in order to ensure uniform irradiation of the samples. Author (NSA)

N69-17635# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
AN NMR STUDY OF THE SOLVENT EFFECTS ON THE N-H CHEMICAL SHIFTS OF AROMATIC AMINES, AMIDES, AND HYDRAZINES Technical Report, Mar. 1967-Jul. 1968
Ronald G. Lewis Oct. 1968 28 p refs
(AD-679542; AFML-TR-68-267) Avail: CFSTI CSCL 7/4

A series of aromatic amines, acetamides, and hydrazines were studied by nuclear magnetic resonance (nmr) spectroscopy. This study concentrates on the chemical shifts of the protons on nitrogen, and how these chemical shifts are affected by solvent and ring substituent. The spectrum of each compound was taken in deuterochloroform, acetone, benzene, and hexadeuterodimethyl sulfoxide where solubility permitted. From these spectra, solvent shifts were obtained for each solvent with CDCl3 as the reference solvent. Also substituent shifts were obtained for pairs of compounds (unsubstituted vs. orthomethyl-substituted; aromatic amines, amides, and hydrazines). These shifts are discussed in terms of solvent: solute complex formation, bond angles about the nitrogen atom, electron density on the nitrogen atom, and steric hindrance to complex formation. The effects of an orthomethyl group on these chemical shifts are discussed in light of the steric requirements of the methyl group. Also the steric requirements of an orthomethyl group could play a large role in determining the mode and geometry of solvent: solute complex formations which affect the chemical shifts of the N-H proton(s). Author (TAB)

N69-17650 Michigan State Univ., East Lansing.
ELECTRON SPIN-LATTICE RELAXATION OF $Cr(CN)_5NO^{3-}$ TRIVALENT ION IN KBr AND KCl
George T. Johnston III (Ph.D. Thesis) 1967 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-4159

Electron spin-lattice relaxation times τ_1 of $Cr(CN)_5NO^{3-}$ substitutional in KBr and KCl have been measured for $1 < T < 150$°K. Spin echo techniques employing either pulsed or single-pulse saturation methods were used. From the temperature dependence of the observed τ_1 values, we conclude that at least three relaxation mechanisms are operative: an anisotropic direct process at T < 5°K, an isotropic Raman process at intermediate temperatures, and an anisotropic local mode process at T > 65°K. Empirical values of A, B, C, and θ_D were determined by least squares computer analysis. Published energy level assignments preclude the possibility of an Orbach process. Dissert. Abstr.

N69-17665# Aerospace Corp., El Segundo, Calif. Lab. Operations.
INTERSYSTEM CROSSING IN PYRENE-H(10) AND PYRENE-D(10), MARCH-AUGUST 1968
Peter F. Jones and Seymour Siegel Oct. 1968 13 p refs
(Contract F04701-68-C-0200)
(AD-679980; TR-0200(9250-01)-2; SAMSO-TR-68-449) Avail: CFSTI CSCL 7/5

The phosphorescence intensity, phosphorescence lifetime, and fluorescence lifetime of pyrene -h(10) and pyrene -d(10) were measured as functions of temperature from 80K to 300K. Using this data, we determine the temperature dependence of the rate constant for intersystem crossing. We find that there are two different routes for intersystem crossing from the lowest excited singlet state S(1) to the lowest triplet state T(o). In addition to a thermally activated transition from S(1) to the first excited triplet state T(1), intersystem crossing occurs directly from S(1) to T(o). Below 100K only the direct transition S(1) to T(o) can compete with the radiative decay of S(1). Author (TAB)

N69-17672# Mellon Inst., Pittsburgh, Pa.
EXPLORATORY DEVELOPMENT AND ANALYTICAL SUPPORT OF EXPERIMENTAL MATERIALS, PART 2 Final Technical Report, 15 Jun. 1967-30 Apr. 1968
John J. McGovern and William G. Fateley Wright-Patterson AFB, Ohio AF Mater. Lab. Oct. 1968 68 p refs
(Contract F33615-67-C-1416)
(AD-678854; AFML-TR-67-303-Pt-2) Avail: CFSTI CSCL 7/4

Elucidation of the structure of various transition metal complexes of pyridine-N-oxide through the use of far-infrared spectroscopy was investigated. New applications and techniques in the field of laser Raman spectroscopy are reported along with various applications of high resolution mass spectroscopy to determine the molecular formula of unknown fluorinated compounds. The application of computer techniques to the analysis of high resolution mass spectral data is discussed in some detail. Purification of 1,1-diiodoferrocene by gas chromatography is described; and other supporting activities and services, including electron microscopy, polymer viscosities and high resolution NMR, are reported. Author (TAB)

N69-17674# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TEMPERATURE DEPENDENCE OF CHEMILUMINESCENT REACTIONS. VOLUME 3: THE SULFUR DIOXIDE AFTERGLOW
Norman Cohen and Rolf W. F. Gross Oct. 1968 15 p refs
(Contract F04701-68-C-0200)
(AD-679974; TR-1001(2240-20)-6-Vol-3; SSD-TR-67-157-Vol-3) Avail: CFSTI CSCL 7/5

The object of the glow discharge shock tube is to be able to fire a mild shock into a flowing gas that has been passed through an electrical discharge. The shock heats and compresses the

gas rapidly, but not to such a high temperature that further dissociation takes place. This technique was applied to the O + SO afterglow. The SO2 afterglow continuum was produced by two independent methods: (a) passing SO2 through a microwave discharge and injecting it into a N2 stream, or (b) passing O2 through the discharge and adding OCS downstream, converting some O atoms to SO by the reaction of O with OCS. In both cases the emission intensity was of second order pressure dependence. Measurements made in different regions of the spectrum showed no wavelength dependence of the temperature exponent. Absolute emission intensity was determined in the O + OCS system at room temperature by using the O + NO afterglow for calibration. The integrated intensity from 2000 to 5000 A gave a rate constant in agreement with previous determinations. Author (TAB)

N69-17711# United Kingdom Atomic Energy Authority, Harwell (England).
THE DETERMINATION OF NITROGEN IN TITANIUM CARBIDE BY THE DUMAS TECHNIQUE
B. J. Hambridge and A. Parker Aug. 1968 8 p
(AERE-AM-108) Avail: CFSTI; UK 2s 6d

The carbide is mixed with copper oxide and heated in two stages in a stream of CO_2 of high purity. The liberated nitrogen is collected, after purification, over 50% KOA solution and its volume measured. The method was applied to the determination of nitrogen in titanium carbide in which the nitrogen content varied between 0.1 and 1.5%. For this level of nitrogen content the sample weight taken for analysis is 50 to 200 mg. Author (NSA)

N69-17712# United Kingdom Atomic Energy Authority, Harwell (England).
DETERMINATION OF HYDROGEN IN ZIRCONIUM ALLOYS BY HOT VACUUM EXTRACTION
Marion Robinson Aug. 1968 7 p
(AERE-AM-107) Avail: CFSTI; UK 1s 9d

Samples weighing from 10 to 200 mg are introduced into a tantalum bucket at 1200°C suspended in a silica furnace tube under high vacuum. Liberated gases are transferred into a known volume, the pressure is measured, and the hydrogen content determined by difference after diffusion through a heated palladium thimble. From comparisons with vacuum fusion analyses, and intercomparison of standard samples with other laboratories, it was concluded that the error of this method does not exceed ±3 percent. An estimate of the precision of the method was obtained from the results of 100 hydrogen determinations where the hydrogen concentrations varied from 20 to 1000 ppm. From the difference between duplicate determinations the coefficient of variation of a single determination was calculated to be ±4 percent. Author (NSA)

N69-17713# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECTS OF IRRADIATION ON THE CONTACT FUSION OF CRYSTALS
I. G. Berzina et al 15 Mar. 1968 11 p refs Transl. into ENGLISH from Politekhn. Inst. Izv. (Tomsk), no. 122, 1962 p 33-38
(AD-679720; FTD-HT-23-111-68) Avail: CFSTI CSCL 7/5

Conducted tests on the effect of irradiation on the contact of fusion crystals were: (1) irradiation of crystals by x-rays, neutrons and gamma-rays from a Ra-alpha-Be source and electrons increases the contact fusion rate; (2) the greatest change the contact fusion rate occurs at temperatures close to the temperatures of the start of contact fusion; (3) the phenomenon of saturation in the dependence of the contact fusion rate upon the dose was observed; (4) radiation-induced defects have unidantical structures and are removed in different temperature intervals; (5) the activation energy of contact fusion of irradiated crystals immediately after irradiation is less than the activation energy of unirradiated crystals. Author (TAB)

N69-17720# MSA Research Corp., Evans City, Pa.
DUST RETARDATION STUDIES OF CARBON DIOXIDE SORBENTS Final Report, Apr. 1967-Feb. 1968
Joseph V. Friel and Frederick Tepper Wright-Patterson AFB, Ohio AMRL Aug. 1968 52 p
(Contract F33615-67-C-1516)
(AD-679561; AMRL-TR-68-41) Avail: CFSTI CSCL 7/4

Surfaces of carbon dioxide sorbent granules were treated with various liquid preparations to diminish dusting tendency and to improve carbon dioxide capacity. Emphasis was placed on a screening program whereby granules of lithium hydroxide were impregnated with solutions of surfactants, organic polymers, and lithium halide salts. Relative effectiveness of treatment was evaluated using a carbon dioxide dynamic capacity test and a dust test. Studies show that latex emulsions significantly diminish dusting tendency of lithium hydroxide granules with only negligible loss in carbon dioxide sorption capacity. Lithium chloride-treated lithium hydroxide results in significantly improved carbon dioxide capacity at low humidity, but such treatment is generally less effective as a deduster than the latex preparation. Excess loadings of surfactants were required to diminish dusting to acceptable limits. Author (TAB)

N69-17726# California Univ., Los Angeles. Dept. of Chemistry.
DETERMINATION OF THE RATE CONSTANTS OF THE INTERSYSTEM CROSSING PROCESSES TO THE INDIVIDUAL MULTIPLETS OF THE LOWEST TRIPLET STATE
M. A. El-Sayed and L. Hall Oct. 1968 8 p refs *Its* Contrib. No. 2342
(Contract Nonr-4756(07); ARPA Order 306)
(AD-679942) Avail: CFSTI CSCL 7/5

Equations are derived which can be used to determine the rate constants for the intersystem crossing processes involved in populating the three zero field spin levels of the lowest triplet states of phosphorescing molecules such as pyrazine. Author (TAB)

N69-17745# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
CARBON DIOXIDE REDUCTION WITH ALKALI-METAL AMALGAMS Final Technical Report, Jan. 1967-Jan. 1968
Richard W. Treharne (Kettering Res. Lab.) and Charles M. Cox Aug. 1968 26 p refs Prepared Jointly with Charles F. Kettering Res. Lab., Yellow Springs, Ohio
(Contract F33615-67-C-1333)
(AD-679597; AMRL-TR-68-36) Avail: CFSTI CSCL 7/1

The reduction of carbon dioxide by alkali-metal amalgams was studied as a potential means for reclamation of carbon dioxide waste gas in space systems. The carbon dioxide reduction reactions were investigated at moderate temperatures and pressures - typically 25 to 200 C and 1 to 1.1 atmospheres. The investigations demonstrated that carbon dioxide can be reduced effectively by an appropriate alkali-metal amalgam system. Moreover, the alkali-amalgam expended in the carbon dioxide reduction process can be reclaimed by electrolysis from an aqueous or nonaqueous salt solution containing the fixed carbon dioxide products. The carbon dioxide fixation products can be drained-off or, in some cases, recycled for further reduction. In the carbon dioxide reduction reactions by alkali-amalgam systems, a wide variety of products ranging from simple organic acids, such as formic and oxalic acid, to totally reduced carbon dioxide in the form of carbon black have

been identified. The types of products formed are dependent upon such factors as the type of alkali-metal amalgam used, temperature, pressure, and electrolytic reducing conditions. In electrolytic recovery of the alkali-metal amalgam from aqueous media, oxygen also is produced as a useful by-product of the carbon dioxide reduction system. Author (TAB)

N69-17771 Ohio State Univ., Columbus.
OSMOTIC PRESSURE OF DILUTE SOLUTIONS OF He^3 In He^4
Mark Ferlin Wilson (Ph.D. Thesis) 1967 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-8896

Measurements of the osmotic pressure have been made between 0.32° and 1.8°K in solutions with less than 2% He^3 concentration. The apparatus consisted of a copper cell containing two chambers, one for pure He^4 and the other for the He^3-He^4 solution. The two chambers were connected with a porous Vycor superleak, which allowed the pure He^4 to communicate with the He^4 component of the solution. The data were gathered in a series of isothermal experiments. The results indicate small deviations from Van Hoff's law for ideal dilute solutions. The data at 0.32°K and 0.65°K have been successfully correlated with a thermodynamic model of the solution. These data suggest that the current theory of the He^3 quasiparticle interaction might be modified to include spin and velocity dependence. Dissert. Abstr.

N69-17774 New York Univ., N. Y.
THE TEMPERATURE DEPENDENCE OF RADIATIVE AND NON-RADIATIVE PROCESSES IN ORGANIC LIQUID SOLUTIONS
Eugene Manuel Levin (Ph.D. Thesis) 1967 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-6081

Investigations into the effects of high temperatures on the fluorescence properties of organic liquid solutions and the effects of high temperatures on the efficiency of solvent-solute energy transfer were studied. The investigations were carried out by determining the intensity of solute fluorescence of solutions of various solute concentrations, at representative temperatures. Three different methods of solute excitation were used. The determination of the temperature dependence of energy transfer efficiency was accomplished using two different methods of excitation. Dissert. Abstr.

N69-17793# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
FORMATION MECHANISMS OF HYDROGEN PEROXIDE IN TITANIUM SULFATE-OXALIC ACID SYSTEM BY THE GAMMA-RAY IRRADIATION
K. Hasegawa [1968] 12 p refs Transl. into ENGLISH from Radioisotopes (Tokyo), no. 16, Sep. 1967 p 428-433 Sponsored by AEC
(RFP-Trans-39) Avail: CFSTI

The formation mechanisms of hydrogen peroxide in titanium sulfate–oxalic acid system by ^{60}Co gamma irradiation was investigated. The radiation yields of hydrogen peroxide formed were measured at titanium ion concentrations (1×10^{-3} to 1×10^{-2} M) and oxalic acid concentrations (1×10^{-3} to 1×10^{-1} M) in 0.8 N sulfuric acid solution. The results obtained were quantitatively consistent with simple reaction schemes for determination of hydrogen peroxide in oxygen gas-esturated system. The hydrogen peroxide yields in the system are attributed to the recombination of OH radical in the spur and the radiolysis of oxalic acid. Author (NSA)

N69-17813# Virginia Inst. for Scientific Research, Richmond.
CHEMICAL CHARACTERIZATION OF MOLECULES ADSORBED ON A FOREIGN SOLID Final Report, 1 Nov. 1964-31 Oct. 1968
Melvin C. Hobson, Jr. 25 Nov. 1968 70 p refs
(Grant AF-AFOSR-734-67)
(AD-679604; AFOSR-68-2774) Avail: CFSTI CSCL 7/4

Spectroscopic techniques have been applied to the study of surface structures of catalysts of supported transition metals. Infrared, visible ultraviolet and Mossbauer spectroscopy have been used, but Mossbauer spectroscopy was found to be the most powerful one for investigation of the adsorbent using iron and its compounds supported on silica gel and alumina. Microcrystallite size of ferric oxide on silica gel and alumina was calculated by Kundigs method from Mossbauer spectra of the catalysts. It was found that reproducible results could be obtained with the silica gel samples, but that the method was severely limited for the alumina samples because of compound formation between the ferric oxide and the alumina. In addition to the compound formed with the alumina support, a ferrous oxide species was observed on reduction of both silica gel and alumina samples. This species did not have the Mossbauer parameters of wustite and could not be observed by x-ray diffraction analysis. For catalyst samples having the smallest crystallite size, 30 to 50 A, two distinct species could be resolved in the spectra of the reduced state. The compounds could be classified in an order of decreasing ability to affect the intensity of the spectrum as follows: ammonia, trimethylamine, methanol > acetonitrile > carbon monoxide, hydrogen. TAB

N69-17830 Michigan Univ., Ann Arbor.
A MEASUREMENT OF THE FINE AND HYPERFINE STRUCTURES OF THE 2^3P STATES OF He^3
Kenneth Raye German (Ph.D. Thesis) 1967 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-7605

This study reports on an experimental determination of the fine and hyperfine structures of the 2^3P term of He^3. The technique used was that of level crossover spectroscopy. In this method the change of the angular distribution of the resonance fluorescence of atoms in a magnetic field when two excited state Zeeman sublevels cross is used to perform a measurement of the crossover field. Eighteen crossovers were observed and ten of these were measured to an accuracy of a few parts per million. The crossover signals were corrected for an asymmetry that arose from both improper optical alignment and the finite sizes of the source and detector. In addition six of the crossovers were investigated for any systematic dependence on pressure, light intensity and discharge intensity, but no shifts were found to an accuracy of about a part per million. Dissert. Abstr.

N69-17838# Toronto Univ. (Ontario). Dept. of Chemistry.
KINETICS OF ATOMIC ASSOCIATION REACTIONS USING FLASH PHOTOLYSIS OVER A WIDE TEMPERATURE RANGE Final Scientific Report, 15 Oct. 1963-14 Oct. 1968
George Burns Nov. 1968 13 p refs
(Grants AF-AFOSR-506-64; AF-AFOSR-506-66)
(AD-679607; AFOSR-68-2756) Avail: CFSTI CSCL 7/4

A summary is given of a detailed study of mechanisms of dissociation-recombination reactions of halogens. For this purpose, the kinetics of three body recombination of iodine and bromine have been studied using a flash photolysis technique up to 1000C. Author (TAB)

N69-17878# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Materials Lab.
THERMAL DEGRADATION OF POLYESTERS. 1: ALIPHATIC POLYMERS Technical Report, 1 Jan. 1967-1 Apr. 1968

Ivan J. Goldfarb and Robert McGuchan Oct. 1966 52 p refs
(AD-676883; AFML-TR-68-182-Pt-1) Avail: CFSTI CSCL 7/4

A study was made of the pyrolysis of eight aliphatic polyesters prepared from various diacids and diols. The polymers start to degrade about 275C by random scission of the ester linkage and are comparable to poly(ethylene terephthalate) with respect to thermal stability. Providing a beta-hydrogen atom is available in the diol portion of the ester, which was the case for the polymers studied, the classical cyclic mechanism observed for the decomposition of simple esters is applicable. Differences in degradation behavior are best explained in terms of secondary reactions which are dependent upon the nature of the end groups formed by scission and on the chain length of the acid and diol used to prepare the polymer. Thus, olefinic end groups break down to aldehydes, dienes, cyclic ethers and enols while acid end groups give carbon dioxide, cyclic detones (C5-C7 diacids) and cyclic anhydrides (C4, C5 diacids). Water is produced by anhydride formation and dehydration of hydroxyl end groups. The overall kinetics were consistent with a random mechanism but deviations from the simple random picture were concluded for some polymers and probably resulted from cross linking. Kinetic parameters were evaluated from programmed TGA data. Author (TAB)

N69-17879# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVICE FOR OBSERVATION OF H(1)-P(31) AND F(19)-P(31) DOUBLE NUCLEAR MAGNETIC RESONANCE BY SPECTROMETERS WITH A FREQUENCY OF 40 MHz
V. B. Lebedev and B. I. Ionin May 1968 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 10, no. 2, 1967 p 29-33
(AD-679952; FTD-MT-24-89-68) Avail: CFSTI CSCL 7/4

A device is proposed for disrupting the spin-spin bond of the H(1) or F(19) nuclei with the P(31) nucleus when recording the spectra of nuclear magnetic resonance by means of spectrometers with an operating frequency of 40 MHz. The device provides for a maximum induction of a 4 Gauss high frequency magnetic field in the sample. The frequency is controlled from 15.3 to 17.6 MHz in 3 steps achieved by varying the capacity and inductance of the tank circuit as well as the capacity of the diode. The latter variation is achieved by a biasing dc voltage. Figures are presented showing the spectrum of proton resonance obtained by means of the device. The device makes it possible to achieve double resonance with high stability and with a uniform frequency control. TAB

N69-17886# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
RESEARCH ON HYPERSONIC CONDENSATION PHENOMENA IN HIGH TEMPERATURE GASES. VOLUME 2. CONDENSATION EXPERIMENTS IN A SHOCK TUBE Final Report, Feb. 1962-Apr. 1968
Theodore J. Falk Aug. 1968 95 p refs
(Contract AF 33(657)-8302)
(AD-679219; CAL-AD-1672-A-4-VOL-2; ARL-68-0143-VOL-2)
Avail: CFSTI CSCL 7/4

Shock tube studies of platinum evaporation and condensation are reported. Platinum was loaded into a shock tube in the form of an aerosol consisting of submicron particles (produced by electrically exploding platinum wire) suspended in an argon or xenon-argon carrier gas. The time required for these particles to evaporate behind a reflected shock was determined by observation of the continuum emission from the particles. The progress of recondensation during a nonsteady expansion was monitored through measurements of light extinction. It was found that shock tube techniques could be used to determine the vapor pressures of refractory metals at high temperatures. Author (TAB)

N69-17890 Wisconsin Univ., Madison.
AN ACCURATE DETERMINATION OF THE HEAT CAPACITY OF SULFURYL FLUORIDE VAPOR
Dennis Clark Gehri (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-7099

Accurate direct measurements of the constant pressure heat capacity of a vapor can be used to check vibrational assignments for the molecule and can also provide information about the pressure dependence of the heat capacity. A correct vibrational assignment for the SO_2F_2 molecule has been the subject of controversy among spectroscopists for fifteen years. The present work was undertaken to provide an independent check of possible vibrational assignments, and the nature of the method allowed the calculation of the pressure dependence of the heat capacity at low pressures. The flow calorimeter designed and built for this work was patterned after that of Masi and Petkof. A major difference between the present calorimeter and the one described by Masi is the method of baffling the flow of vapor in the vicinity of the calorimeter heater. Dissert. Abstr.

N69-17896# California Univ., Berkeley. Lawrence Radiation Lab.
NUCLEAR REACTION OF Cu 63 IN Ni-Cu
Michael H. Bancroft (Ph.D. Thesis) Sep. 1968 72 p refs
(Contract W-7405-ENG-48)
(UCRL-18461) Avail: CFSTI

Nuclear magnetic relaxation of ^{63}Cu in dilute Ni-base-Cu alloys was measured in the temperature range 2.1° to 300°K. The observed spin echo comes from nuclei in the wings of the domain walls in zero applied field and from nuclei in the saturated bulk in large external field. The longitudinal relaxation rate was found to be proportional to the temperature in both cases. $T_1T = 0.1$ sec °K and 1.02 ±0.10 sec °K was found for zero and high external fields, respectively. The difference between these rates is attributed to a mechanism involving the domain walls. Comparison of the high field rate is made with Moriya's calculation for pure transition metal ferromagnets. It is concluded that there is little or no contribution from the d band to the relaxation of an isolated Cu atom in Ni. This strongly suggests that a Cu atom in Ni has no local moment. In the helium temperature range, the transverse relaxation is dominated by spin-spin interactions for Cu concentrations as low as 1%. Author (NSA)

N69-17898 Kansas State Univ., Manhattan.
ATOMIC ABSORPTION CHARACTERISTICS OF BISMUTH AND VANADIUM WITH NOTES ON BORON AND URANIUM
Delbert Allan Marshall (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-9915

An investigation of the atomic absorption characteristics of bismuth, vanadium, boron, and uranium was undertaken. Optimum operating conditions were determined, then flame intensity profiles were obtained, analytical curves prepared, the sensitivities and limits of detection determined, and interference studies were carried out. For bismuth, the most sensitive spectral line was found to be at 3067.72 Å using a hollow cathode lamp current of 8 mA. The determination of vanadium was found to be feasible in the range from 15 to 1,000 μg V/ml using a single burner and a single optical pass through the flame. The 3185.40 Å line was found to be most sensitive for this determination, with an optimum hollow cathode lamp current of 14 mA. The most sensitive line for the determination of boron by atomic absorption spectroscopy was found to be the unresolved doublet at 2497.7/2496.8 Å. For uranium, the most sensitive analytical line appeared to be the 3499.3 Å line, which exhibited a maximum absorption of 6% with a solution containing 10,000 μg U/ml in a Beckman medium bore oxyacetylene burner. Dissert. Abstr.

N69-17901 Illinois Univ., Urbana.
THEORY OF DILUTE SOLUTIONS OF LIQUID He^3 IN He^4 AT LOW TEMPERATURES
Charles Arthur Ebner (Ph.D. Thesis) 1967 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-8059

Various properties of dilute solutions of He^3 in He^4 at temperatures below about 1°K are calculated by viewing the solutions as comprised of interacting He^3 quasiparticles and phonons. The interaction between the quasiparticles is determined phenomenologically by analyzing measurements of the spin diffusion coefficient of solutions of 5.0 and 1.32% He^3 concentration; the quasiparticle-phonon interaction, on the other hand, is found from first-principle arguments. The effective mass of the He^3 quasiparticles, the spin susceptibility, the osmotic pressure, the specific heat, the He^3 chemical potential, and the phase separation temperature are all determined for solutions of various concentrations by doing perturbation theory with the quasiparticle interaction. The coefficient of thermal conductivity is calculated for 1.32 and 5.0% solutions at temperatures below 0.6 K, in which region it is completely determined by He^3-He^3 scattering and He^3-phonon scattering. Dissert. Abstr.

N69-17958 Florida Univ., Gainesville.
EQUILIBRIA IN FORMATION OF HYDROGEN BONDS INVOLVING NITROGEN
David Macklin Porter, II (Ph.D. Thesis) 1967 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-9505

The hydrogen bonding in the succinimide-dimethyl sulfoxide and pyrrole-dimethyl sulfoxide systems has been studied by nuclear magnetic resonance. The concentration and temperature dependence of the chemical shift of the NH resonances of succinimide and pyrrole in dimethyl sulfoxide shows that the succinimide-dimethyl sulfoxide and pyrrole-dimethyl sulfoxide interactions are probably of the n-donor type. For the succinimide-dimethyl sulfoxide system the experimental chemical shift data were interpreted in terms of an equilibrium between a succinimide-dimethyl sulfoxide complex and a succinimide dimer plus solvent molecules. The equilibrium constant for this equilibrium, written for the dissociation of the succinimide-dimethyl sulfoxide complex, was 0.10 at 33°, and determinations of the equilibrium constant at four temperatures gave a ΔH of 5.0 ± 1.0 kcal/mole and a ΔS°_{306} of 11.8 ± 4.0 cal/mole-deg. Dissert. Abstr.

N69-17960 Washington Univ., Seattle.
EQUILIBRIUM SOLUBILITY AND DIFFUSIVITY OF HELIUM IN SINGLE CRYSTAL URANIUM DIOXIDE
Pai Sung (Ph.D. Thesis) 1967 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-9339

Helium saturation solubility and diffusivity in $UO_{2.015}$ was measured over the pressure-temperature range of 700 to 1300 psi and 1200 to 1500° C. The saturation solubility increased with increasing pressure and temperature according to the predicted relationship for stoichiometric UO_2 and agreed in magnitude to within a factor of two. The observed heat of solution was approximately 30 Kcal/mole as compared to a calculated He strain energy of 5 Kcal/mole. The diffusivity could be described by the equation: $D = D_o \exp(-Q/RT)$. The value of Q is 12.7 Kcal/mole. This low activation energy was felt to reflect He diffusion which was unhampered by defect clustering. Increasing pressure increased the diffusivity by a greater factor. The experimental He concentration vs. time curves does follow the spherical particle diffusion equations under this investigation. Dissert. Abstr.

N69-17964# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Heisse Chemie.
URANIUM AND PLUTONIUM DETERMINATION IN NUCLEAR FUEL SOLUTIONS BY X-RAY FLUORESCENCE ANALYSIS
D. Ertel and W. Wettstein [1968] 26 p refs Transl. into ENGLISH from German Rept. KFK-747 Sponsored by US-Euratom Fast Reactor Exchange Program
(EURFNR-531; EUR-3728; KFK-747) Avail: CFSTI

By intensity measurements of the L_{α_1} line, uranium and plutonium can be determined in aqueous and organic solutions in the presence of one another with thorium serving as the internal standard. The analysis region ranges from 0.003 to 10 mg U,Pu/ml. The sensitivity of the method is 10^5 impulses/mg U,Pu/ml. For extreme U/Pu concentration ratios and in the presence of large amounts of impurities, background measurements on each sample are necessary. For rapid determination of uranium and plutonium in pure fuel solutions a routine method was developed. In the optimum measuring region the standard deviation is about ±1%. The time requirement for a single determination is about 15 min and for series analyses about 5 to 10 min. Author (NSA)

N69-17979 Pennsylvania State Univ., University Park.
CHEMILUMINESCENCE IN DIFFUSION FLAMES OF HALIDES BURNING IN VAPORS OF ALKALI METALS
David Warren Naegeli (Ph.D. Thesis) 1967 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-8728

Diffusion flames of numerous inorganic halides burning in potassium vapor at low pressure are found to emit a variety of chemiluminescent atomic and molecular spectra. Chemiluminescence has been observed in low pressure flames created by burning CX_4 and CHX_3 (X = Cl, Br and I) in potassium vapor and in sodium vapor at about 350°C. Chemical mechanisms for the chemiluminescent emissions are discussed. Chemiluminescent emission from OH has been studied in low pressure diffusion flames of potassium vapor with haloforms, with small additions of oxygen. The OH is predissociated. A spectroscopic analysis of some of the findings is given. Dissert. Abstr.

N69-17986# Tyco Labs., Inc., Waltham, Mass.
KINETICS OF REDUCTIVE ABSORPTION OF CARBON DIOXIDE ON SMOOTH Pt ELECTRODES Interim Technical Report
S. B. Brummer Nov. 1968 38 p refs Submitted for publication
(Contract N00014-68-C-0210)
(AD-679620; ITR-4) Avail: CFSTI CSCL 7/4

The formation kinetics of the adsorbed species reduced CO2 (CO2) have been studied with Pt electrodes in 1 M H2SO4 at 40C. Electrochemical transient techniques have been used for characterization of the adsorbate both during its formation and at steady state. Steady state coverage is high and potential independent between 0.00 and 0.25 vs. RHE. The implication of these results for the role of CO2 in the overall fuel to CO2 reaction is discussed. The steady state CO2 adsorbate has the same composition over the whole potential range investigated and comprises two parts. During the approach to the steady state at any potential, the relative amounts of the two components of the adsorbate change. The major component is found at all coverages and comprises the total adsorbate for organic coverage. This species has been suggested to have the composition either C - O or C-OH. Initial adsorption rates are first order in CO2 and adsorbed hydrogen and zero order in free surface. The reaction at low coverage is suggested to occur via a pre-adsorbed CO2 layer similar to the type C adsorbed hydrogen postulated in gas phase adsorption studies. TAB

N69-18000 Pittsburgh Univ., Pa.
MEASUREMENT OF LIQUID-LIQUID INTERFACIAL DISTURBANCES
Regis Richard Stana (Ph.D. Thesis) 1967 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-9746

A technique based on the principle of surface potential has been developed for the measurement of interfacial activity at a liquid-liquid interface. The apparatus consisted of a micro-electrode system capable of sensing the small disturbances in terms of the change of electrical potential induced by the interfacial double layer. Experiments were conducted to measure the fluctuations, at the interface between water and ethyl acetate, generated either by a mechanical device or by diffusional fluxes. The vibration of various screens placed beneath the interface produced reproducible fluctuation of the interface and served as a test for the measuring technique. The interfacial activity induced by the diffusion of acetic acid was determined for various acid concentrations, three to 30 weight per cent in the water-ethyl acetate system. The results showed that the interfacial activity was at least four times greater when the acid was transferring from the ethyl acetate phase to the water phase as compared to transfer in the opposite direction. For unsteady state acid transfer from the ethyl acetate phase to the water phase, the intensity of the turbulence was irregular and varied sporadically. However, the addition of water initially into the ethyl acetate phase suppressed the irregularities. Dissert. Abstr.

N69-18001 California Univ., Berkeley.
A METHOD FOR THE CONTROL OF A FIXED-BED CHEMICAL REACTOR
Bruce Eliot Stangeland (Ph.D. Thesis) 1967 274 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.55 Order No. 68-10415

Disturbances in temperature and concentration in fixed-bed chemical reactors propagate as traveling waves at different velocities because of the retarding effect of heat and mass transfer between the fluid and solid phases. At the same time they interact with each other through their influence upon the reaction rate. The presence of these waves constitutes on the one hand an important control problem and on the other hand represents a mechanism for achieving this control. In this work this interaction is used to advantage by introducing additional waves through injection of a secondary reactant stream. These controlling waves move through the bed with the original distrubances, interact with them, and annihilate them before they reach the end of the reactor. This control strategy is applied to an adiabatic packed-bed reactor in which a first-order exothermic reaction occurs in the fluid phase. Dissert. Abstr.

N69-18007# Dow Chemical Co., Midland, Mich. Thermal Research Lab.
JANAF THERMOCHEMICAL TABLES Third Addendum, Jun. 1967-Jun. 1968
Daniel R. Stull, J. Chao, A. T. Hu, G. C. Karris, H. Prophet et al Aug. 1968 175 p refs
(Contracts AF 04(611)-11201; F04611-67-C-0009)
(PB-168370-3) Avail: CFSTI CSCL 07D

This third addendum to PB 168370 represents the additions and revisions made by the Dow Thermal Research Laboratory during the period June 1967 and June 1968. Author (USGRDR)

N69-18034 Arkansas Univ., Fayetteville.
A STUDY OF THE CONDUCTIVITY IN PURE AND MIXED SOLVENTS AND AT VARIOUS TEMPERATURES OF ELECTROLYTES FROM DILUTE TO SATURATED CONCENTRATIONS: A. MAGNESIUM CHLORIDE IN THE WATER-ETHANOL SYSTEM. B. CESIUM CHLORIDE IN THE WATER-ETHANOL SYSTEM
Maung Aung Than (Ph.D. Thesis) 1968 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-9627

The conductance of magnesium chloride was measured in water and in mixtures of water and ethanol having approximately the following compositions 20.3, 39.8, 60.2, 80.4 and 100 weight percent ethanol in water, while the conductance of cesium chloride was measured in water and in mixtures of water and ethanol having approximately the following compositions 29.79, 59.69, 89.14 and 100 weight percent ethanol in water. Measurements were made at 25.00, 35.00 and 45.00°C in each solvent for concentration of magnesium chloride and cesium chloride ranging from saturation down to about 10^{-3} equivalents per liter. Dissert. Abstr.

N69-18044*# National Bureau of Standards, Washington, D.C.
THERMAL AND OXIDATIVE DEGRADATION OF AROMATIC AND HETEROCYCLIC POLYMERS Progress Report, 1 Aug. 1968-1 Feb. 1969
Leo A. Wall 1 Feb. 1969 12 p refs
(NASA Order R-56)
(NASA-CR-99332; Rept-31102-11-31/0540) Avail: CFSTI CSCL 07C

Thermal and oxidative degradation mechanisms of aromatic and heterocyclic polymers were studied by weight loss and solubility rates. Samples of polypyromellitimide (Kapton) films with 5 mil surface area decomposed faster in air than samples of 0.5 mil surfaces; higher oxygen concentration rates increased decomposition rates also. The relationship of thermal crosslinking and swellability of the residual polymer was investigated on the polycarbonate of bisphenol-A at two temperatures. Results indicated the existence of a definite crosslinking process in competition with scission and stripping processes. G.G.

N69-18047# Atomic Energy Commission Research Establishment, Riso (Denmark).
SEPARATION OF Fe-59 SUPP III AND Fe-59 SUP II IN NEUTRON-ACTIVATED CRYSTALLINE FERROUS COMPOUNDS
K. E. Siekierska and J. Fenger Jun. 1968 21 p refs
(RISO-183) Avail: CFSTI

A method of separation of labelled $Fe^{(II)}$ and $Fe^{(III)}$ in heterogeneous systems is described. Electron exchange is avoided by formation of the ferrous dipyridyl complex followed by precipitation of ferric hydroxide. The effects of varying concentrations of the components have been examined. The possibilities of applying the method in hot-atom studies on ^{59}Fe in ferrous compounds are briefly discussed. Author (NSA)

N69-18049# Kernforschungszentrum, Karlsruhe (West Germany) Inst. fuer Radiochemie.
SYNERGISTIC EFFECT IN THE EXTRACTION OF YTTRIUM AND AMERICIUM WITH KETONE [SYNERGISTISCHE EFFEKTE BEI DER EXTRAKTION VON YTTRIUM UND AMERICIUM MIT KETONEN]
H. Schweizer Jul. 1968 67 p refs In GERMAN
(KFK-766) Avail: CFSTI

In the comparison of the extraction of Am(III) and Y(III) by substituted 1,2- and 1,3-diketones in chloroform and methyl isobutyl ketone (hexone) as the organic phase, a preferential extraction in hexone was established. This phenomenon was explained as a synergistic effect. A synergistic effect could also be established in methyl butyl ketone, methyl tert-butyl ketone, diisobutyl ketone, and butylcyclohexanone. The extraction of Am(III)

and Y(III) with 1,2- and 1,3-diketones can be expressed by the relation $Me^{3+} + 3L^- \rightarrow (MeL_3)_w \rightleftarrows (MeL_3)_o$. The yttrium chelates are more stable than the Am chelates. The $pH_{1/2}$ value of the Y is 0.13 to 0.40 units lower than that of Am. In the same chelating agent and the same organic phase, YL_3 has a higher distribution coefficient than AmL_3. The synergistic effect in the extraction of ML_3 in monoketones (A) as the organic phase was carried out by the formation of adduct chelates. The stability constants of these adducts were calculated with the help of a graphic method. Author (NSA)

N69-18053# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PERTURBATION THEORY AND EQUATION OF STATE FOR FLUIDS
Dominique Levesque and Loup Verlet Nov. 1968 35 p refs
(TH-68-35) Avail: CFSTI

In the perturbation theory studied by Barker and Henderson, an expansion is made of the free energy in terms of a strength parameter λ that multiplies the attractive part of the potential. This expansion is shown here to converge very rapidly for the Lennard-Jones liquid. Taking as a zero order approximation the system with only repulsive forces, Barker and Henderson have shown that it can be approximated by hard spheres with a temperature-dependent diameter. By a direct computation it is shown this approximation is excellent. In the spirit of the λ expansion, a semi-empirical equation of state is written which is applied with success to the Lennard-Jones fluid, argon, and xenon. It is seen that the large scale density variation characteristic of the critical point lowers the critical temperature by 6%. Author

N69-18063*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIALS RESEARCH AT MSFC
Charles E. Cataldo, James E. Curry, Raymond L. Gause, James E. Kingsbury, and Eugene C. McKannan *In its* Res. Achievements Rev., Vol. 2 1968 55 p refs (See N69-18059 07-34)
Avail: CFSTI CSCL 11

The diffusion bonding process and construction of diffusion bonded dissimilar metal joints are briefly described. Construction of four tank assemblies by the diffusion bonding process was followed by cycling and burst tests to determine the strength of the bonded joints. Some of the more critical stress corrosion failures that were experienced at the Center are briefly recounted, along with corrective action taken. Specific problems described are the H-1 engine LOX dome, the pneumatic line fitting sleeve problems, and wave springs used on MF-flared tube fittings. The factors that result in a failure caused by stress corrosion are discussed and the various methods used to detect stress corrosion are mentioned. The role of nondestructive testing in solving the stress corrosion problem is outlined. New materials were developed for the fabrication of dc motor brushes and wire coatings. The electrical properties of cryogenic fluids and potting compounds were studied. Nonmetallic materials research included work on cryogenic insulation, adhesives, and diffusion through polymeric membranes. B.P.

N69-18082 Washington Univ., St. Louis, Mo.
EPR STUDY OF CYANOCHROMATE COMPLEX ION
Alexander Wolberg (Ph.D. Thesis) 1968 55 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10789

To study the EPR spectrum of $Cr(CN)_6$ complex ion in high symmetry environment, a cubic host crystal of $Cs_2LiCo(CN)_6$ was synthesized. Single crystal X-ray diffraction determination showed that this is a cubic crystal, belonging to O^5_h-Fm3m space group with four molecules per unit cell. The Fourier analysis confirmed that all Co-C and C-N bond lengths are identical. The Debye-Waller temperature factors are different for the different atoms. This indicates that the nitrogen and cesium atoms have larger vibrational amplitudes than those of the carbon and the cobalt atoms. Dissert. Abstr.

N69-18069# Michigan State Univ., East Lansing.
[METAL-AMINE SOLUTIONS] Technical Progress Report, Sep. 16, 1967-Sep. 15, 1968
James L. Dye Sep. 1968 16 p refs
(Contract AT(11-1)-958)
(COO-958-13) Avail: CFSTI

Developments are reported for studies on: metal-amine research; models for metal-ammonia solutions; optical spectra in metal-amine solutions; EPR studies of metal-amine solutions; kinetics of metal-amine reactions; and molecular-orbital calculations. NSA

N69-18113# Tube Investments Research Labs., Cambridge (England).
THE CALCULATION OF STOPPING POWER AND BACKSCATTER EFFECTS IN ELECTRON PROBE MICROANALYSIS
P. Duncumb and S. J. B. Reed (Brit. Museum) 26 May 1967 3 p refs Presented at the Seminar on Quant. Electron Probe Microanalysis, Washington, D. C. 12-13 Jun. 1967
(TR-221; CONF-670655-1) Avail: CFSTI

The problem of calculating backscatter factors and stopping power for atomic number corrections in quantitative microprobe analysis is discussed. It is concluded that the stopping power S is best calculated from Bethe's formula, using values of the mean ionization potential J determined empirically from analyses of known compounds. A table of J values for practical calculations is given. Values of the backscatter factor R are also given from calculations, using Bishop's experimental measurements of electron backscattering coefficients and energy distributions. Simplifications of the theory are discussed, together with methods of averaging S and R for compounds. The accuracy and range of application of the atomic number correction are considered, and areas where further experimental work might lead to useful improvements are indicated. Author (NSA)

N69-18116# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
GEL-ADDITION PROCESS CHEMICAL STUDIES Quarterly Progress Report, May-Jul. 1968
E. H. Dewell, comp. Sep. 1968 30 p refs
(Contract AT(30-1)-3714)
(BAW-3714-8; QPR-8) Avail: CFSTI

The development of the sol-gel process and related processes for preparing (U, Pu)O_2 fast reactor fuels is described. Development of the Oak Ridge mixed sol process was expanded. The last of the scheduled test work on the gel-addition process was completed with the demonstration that Pu(III) is picked up from aqueous solution and retained by UO_2 gels through at least two mechanisms. About half the Pu(III) picked up in a single contact was leached from the gel with either water or aqueous ammonia. The remainder was fixed. The total was fixed when the gel was dried before leaching. The total pickup from 0.45 M Pu(III) nitrate solution was 4.7% (Pu/U + Pu) in one contact. Procedures for polishing pellet specimens for ceramographic examination are nearly complete. $HF-HNO_3$ solutions give an excellent etch, but additional work is needed to find ways of stopping the etchant action at the required point. NSA

N69-18143*# Lockheed Electronics Co., Houston, Tex.
MATRIX ELEMENTS OF ATOMIC INTERACTION OPERATORS FOR d^n CONFIGURATIONS

J. A. Barnes, B. L. Carroll, L. M. Flores, and R. M. Hedges (Texas A&M Univ.) Jan. 1969 67 p refs
(Contract NAS9-5364)
(NASA-CR-99504) Avail: CFSTI CSCL 07D

The matrix elements of the coulomb, spin–orbit, orbit–orbit, spin–spin, and spin–other–orbit operators for d^n (n = 2,...,8) configurations are computed and tabulated for general usage. Author

N69-18158# Dow Chemical Co., Midland, Mich.
MOLECULAR CHARACTERIZATION OF POLYMERS
L. H. Tung *In* Soc. of Plastics Engr., Inc. Design of Expt. and Data Analysis in Plastics Eng. 1968 p 1–6 refs (See N69-18157 07-18)
Avail: Issuing Activity

The nature of the bonds linking monomeric units of polymers and the geometry of the chain structures are discussed. Various methods of characterizing polymer molecules are reviewed: gel permeation chromatography, ultracentrifugation, viscosity measurements, and molecular weight determinations. Several conventional analytical tools are also important in elucidating the structure of polymers: differential thermal analysis, X-ray diffraction, electron microscopy, dynamic property measurements, etc. B.P.

N69-18160# Canadian Industries, Ltd., McMasterville (Quebec). Central Research Lab.
FLOW PROPERTIES OF PLASTICIZED PVC: REDUCTION TO COMPOSITION AND INTERACTION VARIABLES
H. P. Schreiber *In* Soc. of Plastics Engr., Inc. Design of Expt. and Data Analysis in Plastics Eng. 1968 p 19–23 refs (See N69-18157 07-18)
Avail: Issuing Activity

An attempt is made to rationalize the flow properties of plasticized polyvinylchloride (PVC) compounds by applying widely recognized concepts of polymer rheology and polymer diluent interaction. The unique flow curves derived for unplasticized PVC from the flow data of plasticized compounds, indicated that master curves for various levels of plasticization could be constructed by a reduced variable treatment. Inspection of shift factor values and of the kT slopes indicated a strong dependence on the type of plasticizer used. An interaction parameter was suggested for the correlation of actual values of these parameters with values of a polymer–plasticizer interaction parameter. B.P.

N69-18169# Centro Informazioni Studi Esperienze, Milan (Italy).
INDEXING OF ELECTRON DIFFRACTION SPOTS OBTAINED FROM ZIRCONIUM LATTICE
A. Gardini Jun. 1968 53 p refs
(CISE-116) Avail: CFSTI

The theoretical notions necessary to carry out the analysis of electron-diffraction patterns, with particular reference to hexagonal lattices, are briefly reported. The difficulties encountered in analyzing zirconium lattice and the method followed to overcome them are dealt with. Finally, the results of a series of measurements for the determination of the diffraction constant and a repertory of 48 schemes useful in indexing zirconium lattice diffraction spots are reported. Author (NSA)

N69-18196# Naval Research Lab., Washington, D. C.
IONIC TRANSPORT IN POTASSIUM CHLORIDE
R. G. Fuller, C. L. Marquardt, M. H. Reilly, and J. C. Wells, Jr. *In its* Rept. of NRL Prog. Nov. 1968 p 3–13 refs (See N69-18196 07-34)
Avail: CFSTI

The electrical conductivity and chlorine ion diffusion in KCl and KCl:$SrCl_2$ single crystals were measured. These data were analyzed with least squares methods by using as a model a perfect crystal perturbed by five defects: isolated anion vacancies, isolated cation vacancies, isolated divalent cation impurities, divalent cation impurity-cation vacancy complexes, and vacancy pairs. The transport equations were derived from this five defect model by use of a simple theory for noninteracting particles except for the nearest neighbor binding to form complexes and vacancy pairs, and by using the same theory including long range coulomb interactions between the isolated defects. This latter formulation of the transport equations yielded the better description of the experimental results. However, the analyses showed that significant nonrandom deviations exist between theory and experiment. These deviations exist in both the intrinsic and extrinsic regions of conductivity. The failure of existing concepts for these transport properties is discussed in terms of possible additional mechanisms, i.e., electron, cationic Frenkel defects, and trivacancies, and in terms of more complete theoretical treatment. Author

N69-18213#
INVESTIGATION OF THE CURRENT GENERATION MECHANISM IN OXYGEN ELECTROREDUCTION ON HALF-IMMERSED PLATINUM ELECTRODES OF VARYING ROUGHNESS
M. R. Tarasevich et al 1968 12 p refs Transl. into ENGLISH from Elektrokhim. (USSR), v. 4, no. 11, 1968 p 1306–1315
Avail: CFSTI

Oxygen ionization on half-immersed platinum electrodes with varying roughness is investigated. It is shown that for low polarizations and roughnesses the current is a linear function of the roughness factor, and a deviation from the linear dependence and emergence of the curves into a plateau are observed as this factor increases. The operating mechanism of a half-immersed electrode with a porous layer is examined theoretically, and three limiting modes of electrode operation are determined. It is shown that the effective reaction zone can extend within the porous layer. Author

N69-18214#
INVESTIGATION OF OXYGEN ELECTROREDUCTION ON A SMOOTH PLATINUM ELECTRODE PARTIALLY IMMERSED IN ELECTROLYTE
R. Kh. Burshtein et al [1968] 7 p refs Transl. into ENGLISH from Elektrokhim. (USSR), v. 4, no. 11, 1968 p 1281–1285
Avail: CFSTI

Oxygen electroreduction on a smooth semi-immersed platinum electrode in acid and base media is investigated for different surface treatment. It is shown that there is a stable film of electrolyte on the oxidized surface of the electrode above the upper edge of the meniscus. Reduction of the surface leads to degradation of the wettability, and under specific conditions, to rupture of the film and the formation of an electrolyte lens. Author

N69-18245# Bettis Atomic Power Lab., Pittsburgh, Pa.
AN EVALUATION OF ETA FOR URANIUM 233 AT 0.025 eV USING THE RECAP-4C MONTE CARLO PROGRAM (LWBR DEVELOPMENT PROGRAM) Interim Memorandum
C. J. Emert, S. Milani, and N. R. Candelore Sep. 1968 15 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-772) Avail: CFSTI

With few exceptions, the values of $\bar{\nu}$ for the fissile isotopes have been measured relative to the value of $\bar{\nu}$ for ^{252}Cf. However, an examination of the reported values of $\bar{\nu}$ for ^{252}Cf reveals a considerably greater spread in magnitude than is suggested by the accuracies of the individual measurements. The recommended values of $\bar{\nu}$ have been derived with heavy reliance upon η and α

measurements. Because of the importance of eta, an analysis was performed ... an experiment that measured the value of η for ^{233}U, ^{235}U, and ^{239}Pu. The results of an analysis of a monoenergetic 0.025-eV measurement of eta for ^{233}U using the recently developed RECAP-4C Monte Carlo program are presented. This analysis lends additional support to the eta value of 2.298 at 0.025 eV and indirectly to the value of $\bar{\nu}$ based upon this value of eta. Author (NSA)

N69-18260# Naval Research Lab., Washington, D. C. Solid State Div.
TRIVACANCY CONTRIBUTION TO IONIC CONDUCTIVITY
R. G. Fuller and M. H. Reilly *In its* Rept. of NRL Progr. Dec. 1968 p 5–7 refs (See N69-18258 07-34)
Avail: CFSTI

Experimental measurements of the temperature dependence of the intrinsic conductivity of alkali chloride single crystals are reported. These results show an anomalous behavior near the melting points of these materials. The possible explanation of this anomaly by a trivacancy contribution to the ionic conductivity is discussed. It is predicted that the cation trivacancy is favored over the anion type. Hence, the presence of trivacancies might be verified by high temperature conductivity measurements in alkali halide crystals containing large amounts of divalent cation impurities. Author

N69-18274 Michigan Univ., Ann Arbor.
THE ROLE OF CROSS RELAXATION IN THE EXTRA ENDOR SPECTRUM OF VANADIUM IN TUTTON SALT CRYSTALS
Joseph Le Fevre Horner (Ph.D. Thesis) 1967 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-7630

An investigation has been made of the ENDOR (electron nuclear double resonance) spectrum of the paramagnetic complex VO^{2+} imbedded in a diamagnetic host crystal of the Tutton salt. In a normal ENDOR spectrum, either two lines or four lines are observed, depending on whether one of the two outermost EPR transitions or an inner EPR transition is induced. In the present case, up to fourteen ENDOR lines are observed. A calculation of the nuclear sublevels of the system, made from the rhombic spin Hamiltonian using perturbation theory through the second order, reveals that the extra ENDOR lines arise from transitions occurring among all fourteen nuclear sublevels. This breakdown of the normal ENDOR phenomenon can be understood in terms of interactions among neighboring Vanadium atoms. Dissert. Abstr.

N69-18298 Illinois Univ., Urbana.
STRAIN-MODIFIED SPIN-LATTICE RELAXATION RATES IN SOME RARE EARTH SALTS
Byron Arlen Young (Ph.D. Thesis) 1967 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-8276

An examination was made of the electron spin-lattice relaxation rates of Ce and Er in $LaCl_3$ progressively strained by replacing a small fraction of the Cl ions by Br and also Nd in lanthanum magnesium nitrate (LMN) similarly strained with Zn replacing Mg in order to test our proposal that strain-induced excited level energy widths in rare earth crystals could explain the discrepancies in excited state energy levels as determined by optical and spin-lattice relaxation data. Relaxation times were measured in the temperature range 1.5°K to 4.2°K using a pulsed-power X-band microwave spectrometer. The results indicate that for 2% Ce in $LaCl_3$ lattice, σ^2 is 43, 65, and 95°K^2 for Br concentrations of 0, 5, and 10% respectively, and for 1% Er in a $LaCl_3$ lattice, σ^2 is 7 and 31°K^2 for Br concentrations of 3% and 6% respectively, providing strong evidence for the validity of our proposal. For Nd in LMN with 0% and 10% Zn, σ is about 11 °K indicating the ion substitution had little effect on the crystal field splittings. Dissert. Abstr.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-17245# Rensselaer Polytechnic Inst., Troy, N. Y. Div. of Systems Engineering.
THE CALCULATION OF PROPAGATION CONSTANTS OF A PERIODICALLY LOADED MULTIMODE CIRCULAR WAVEGUIDE
Dean Arden and John Riganati Jul. 1968 93 p refs
(Contract C-117-66; Proj. Tubeflight)
(PB-180279; TR-DSF-6801) Avail: CFSTI CSCL 13F

Operation of a circular waveguide at frequencies considerably above cutoff in order to obtain a low attenuation for the circularly symmetric transverse electric modes results in a system capable of propagating many modes. The stability of the launched TE_{01} energy is a function of both the deviations of the guide from a true right circular cylinder and the mode structure. Guide modifications based on the natural dichotomy between the desired and spurious mode forms may be designed to increase this stability by modifying the mode structure. One way to determine the effect of any periodic modifications is to compute the scattering matrix for each junction and to apply Floquent's theorem. For a modification consisting of a narrow circumferential gap, coupled to either free space or an off resonance coaxial cavity, the scattering matrix may be found if the field in the gap is known. A field equivalence theorem is presented and used to formulate equations for the solution of the electromagnetic boundary value problem for this field. Author (USGRDR)

N69-17359# State Univ. of New York, Stony Brook. Coll. of Engineering.
ELECTROMAGNETIC RADIATION FROM QUASI-PERIODIC STRUCTURES Final Report, 1 Jun. 1967–30 Jun. 1968
Richard B. Kieburtz 26 Jul. 1968 11 p refs
(Contract F19628-67-C-0056)
(AD-679761; AFCRL-68-0463) Avail: CFSTI CSCL 20/14

The results of theoretical and experimental research on periodic, traveling-wave dipole arrays and their application to the design of log-periodic antennas is summarized. This research has contributed to a better understanding of the mechanism of radiation from such structures, and has led to a proposed method for controlling the excitation of a log-periodic dipole array. The work has also pointed to the need for more vigorous theoretical foundation for coupled-mode theory, and such an investigation has been performed. Author (TAB)

N69-17472# Sylvania Electronic Systems-East, Waltham, Mass. Applied Research Lab.
RADIATION PATTERNS OF A SLOT ANTENNA IN THE PRESENCE OF A BREAKDOWN SHEATH
Michael H. Mentzoni and James Donohoe Nov. 1968 38 p ref
(Contract AF 19(628)-5718)
(AD-680000; S-5158-13; SCIENTIFIC-13; AFCRL-68-0601) Avail: CFSTI CSCL 9/5

The plasma sheath which characterizes aperture breakdown causes severe attenuation and phase distortion of the transmitted signal in the broadside direction. The experimental radiation pattern and the effects of the breakdown sheath are investigated for a wide range of pressures and breakdown power levels. Author (TAB)

N69-17564# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SIGNAL-TO-NOISE THRESHOLD RATIO DURING TARGET DETECTION ON A REFLECTING BACKGROUND
L. B. Fuks 5 Apr. 1968 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron (USSR), v. 10, no. 5, 1967 p 443–448
(AD-679499; FTD-HT-23-1567-67) Avail: CFSTI CSCL 17/9

The article presents the results of an analytical study of the radar signal-to-noise threshold ratio during target detection on a reflecting background. The radar system (in the average case) is reduced to a typical block diagram: a linear part, a detector, and an integrator. The linear part is characterized by the range selectivity. Thus, the computation of the signal-to-noise threshold leads to two well-known operations: (1) determination of the signal-noise ratio at the detector input, and (2) determination of the gain in the threshold signal owing to the post-detector processing. On the basis of such approximations, a simple formula is derived which determines the threshold ratio between reflecting properties of the target and the background. The analysis indicates that the additional gain in the threshold signal can be obtained only as a result of the intraperiodical post-detector integration; such integration is effective only in cases when the duration of the useful signal can be considerably increased, or if the correlation interval of the interference can be reduced without any change of resolution in respect to range. Author (TAB)

N69-17565# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPPRESSING PULSE NOISES BY MEANS OF A SUBTRACTION CIRCUIT
Ya. I. Gronskiy et al 2 Feb. 1968 6 p refs Transl. into ENGLISH from Akad. Nauk Ukr SSSR, Elementy Sistem Otbora i Peredachi Inform. (Kiev), 1965 p 168–171
(AD-679735; FTD-HT-23-1577-67) Avail: CFSTI CSCL 9/5

Various band, blocking, and other filters made of LC or RC elements for the separation of the useful signal from a background of strong harmonic noise can be utilized with success only if the perturbation has a continuous character. The author gives a description of difficulties encountered with pulsed perturbations, and presents a brief description of the design and operation of the circuit capable of separating out brief signals from the background of pulsed perturbations exceeding the useful signal by 70 to 80 db. The use of a substraction circuit in conjunction with a low Q-factor RC filter results in a quality signal filtration in the presence of sharp radiopulse perturbations. Author (TAB)

N69-17567# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MILLIMETER-WAVE PROPAGATION AND SYSTEMS CONSIDERATIONS Technical Report, Mar. 1963-Jun. 1968
L. A. Hoffman Oct. 1968 101 p refs
(Contract F04701-68-C-0200)
(AD-679978; TR-0200(4230-46)-1; SAMSO-TR-68-445) Avail: CFSTI CSCL 17/9

Applications for millimeter waves are discussed, and it is shown how propagation effects enter into systems considerations for the EHF region. The state of the millimeter-wave art is reviewed as to antennas, sources, amplifiers, and receivers. Highlighted are two applications, a high-resolution radar, which it is hoped can utilize the inherent advantage of the short millimeter wavelengths for resolution, and a space-to-space communication system at EHF. Author (TAB)

N69-17583# Naval Research Lab., Washington, D. C.
CERTAIN M-ARY DIGITAL SATELLITE COMMUNCIATION SYSTEMS
Noel C. Baithasar and Hugo M. Beck Oct. 1968 13 p refs
(AD-679570; NRL-MR-1929) Avail: CFSTI CSCL 17/2.1

A general review of M-ary signalling techniques is given, especially in relation to their use in secure digital voice and teletype applications, and considering their suitability for relatively narrow band active and passive satellite communication. This study is considered basic to subsequent work on wide band modulation techniques and applications. Author (TAB)

N69-17628# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
'ORBITA' SPACE SYSTEM. WORLD WIDE TELEVISION SYSTEM BEING SET UP IN THE USSR
Yu. Dmitriyev 28 Mar. 1968 6 p Transl. into ENGLISH from Trud (USSR)
(AD-679497; FTD-HT-23-1467-67) Avail: CFSTI CSCL 17/2

The document discusses the construction of a USSR network of dish antennas, which has been named Orbita. They will be used to receive television programs bounced off satellites. Author (TAB)

N69-17734# Sylvania Electric Products, Inc., Waltham, Mass. Applied Research Lab.
THE INSULATED CYLINDRICAL ANTENNA IMMERSED IN A COMPRESSIBLE PLASMA
Janis Galejs Oct. 1968 34 p refs
(Contract AF 19(628)-5718)
(AD-679999; S-5158-10; AFCRL-68-0577; SR-10) Avail: CFSTI CSCL 9/5

A cylindrical antenna is embedded in a dielectric cylinder, which is surrounded by a compressible isotropic electron plasma. The antenna impedance is formulated variationally by considering the effects of surface waves supported by the antenna structure. The surface waves alter the antenna current distribution for frequencies near the plasma frequency, but their amplitude is decreased with increasing thickness of the antenna insulation. The antenna solution is verified by examining the electric surface fields excited by the approximated antenna current distributions, and the results are also compared with other numerical solutions. Author (TAB)

N69-17748*# Teledyne Systems Co., El Segundo, Calif. Control Systems Div.
ULTRAMINIATURE TELEVISION CAMERA Final Report, Jun. 1967–Feb. 1968
Robert J. Sussman Mar. 1968 86 p
(Contract NAS8-20768)
(NASA-CR-98279) Avail: CFSTI CSCL 17B

The development work accomplished under the terms of this contract produced a modification in the physical and electrical design of the ultraminiature television camera prototype with transmitter. These modifications are to enable the camera to pass certain environmental tests. One camera has been designed, fabricated, tested, and delivered under this contract. Author

N69-17754# Defense Communications Agency, Washington, D. C.
DEFENSE COMMUNCIATIONS SYSTEM APPLICATIONS ENGINEERING MANUAL. VOLUME 1: SYSTEM PLANNING AND PERFORMANCE CRITERIA
May 1968 798 p refs Supersedes DCA-Circ-370-185-1-Vol-1, 19 Apr. 1966
(AD-678711; DCA-Circ-370-185-1-Vol-1) Avail: CFSTI CSCL 17/2

The current edition of this manual consists of five volumes. Volume I is devoted to basic engineering design information

relative to communication systems. The remaining volumes provide the descriptions and technical specifications for major subsystems, minor subsystems, components, and transportable units. Volume I for 1968 includes handbook type design information. The following subjects are covered: General instructions for the use of these volumes; Communication requirements collection and analysis; Costing guidelines and economic tradeoffs; Support requirements considerations; DCS interface design considerations; Communication satellite subsystems; User subsystems, routing, and control; High frequency subsystems; Scatter subsystems; Line of sight microwave subsystems; Wire and cable subsystems; Submarine cable subsystems; AUTOVON and AUTODIN; Technical control subsystems; Error control considerations; Modulation techniques; Multiplex techniques; Environmental control subsystems; Power subsystems; and Personnel subsystems. Author (TAB)

N69-17755# Defense Communications Agency, Washington, D. C.

DEFENSE COMMUNICATIONS SYSTEM APPLICATIONS ENGINEERING MANUAL. VOLUME 2: FIXED STATION EQUIPMENT

May 1968 768 p refs Supersedes DCA-Circ-370-185-1-Vol-2, 19 Apr. 1966

(AD-678712; DCA-Circ-370-185-1-Vol-2) Avail: CFSTI CSCL 17/2

This volume describes telegraph, telephone, and radio fixed station equipment. TAB

N69-17756# Defense Communications Agency, Washington, D. C.

DEFENSE COMMUNICATIONS SYSTEM APPLICATIONS ENGINEERING MANUAL. VOLUME 3: FIXED STATION EQUIPMENT

May 1968 852 p refs Supersedes DCA-Circ-370-185-1-Vol-3, 19 Apr. 1966

(AD-678713; DCA-Circ-370-185-1-Vol-3) Avail: CFSTI CSCL 17/2

This volume describes microwave and other fixed station equipment, and various test equipment. TAB

N69-17757# Defense Communications Agency, Washington, D. C.

DEFENSE COMMUNICATIONS SYSTEM APPLICATIONS ENGINEERING MANUAL. VOLUME 4: FIXED STATION EQUIPMENT

May 1968 524 p refs Supersedes DCA-Circ-370-185-1-Vol-4, 19 Apr. 1966

(AD-678714; DCA-Circ-370-185-1-Vol-4) Avail: CFSTI CSCL 17/2

This volume describes generators, radio equipment, and teletype equipment. TAB

N69-17758# Defense Communications Agency, Washington, D. C.

DEFENSE COMMUNICATIONS SYSTEM APPLICATIONS ENGINEERING MANUAL. VOLUME 5: TRANSPORTABLE SETS

May 1968 737 p refs Supersedes DCA-Circ-370-185-1-Vol-5, 19 Apr. 1966

(AD-678715; DCA-Circ-370-185-1-Vol-5) Avail: CFSTI CSCL 17/2

Contents: Communication relay ships; Satellite communication terminals; Radio sets; Teletypewriter central office; and Communications centrals. TAB

N69-17798# Naval Research Labs., Washington, D. C.

NRL TERRAIN CLUTTER STUDY, PHASE 2 Final Report

John C. Daley, Willie T. Davis, James R. Duncan, and Michael B. Laing Oct. 1968 46 p refs

(AD-679568; NRL-6749) Avail: CFSTI CSCL 17/9

The second and final phase of a terrain clutter study was completed at Naval Research Laboratory utilizing the Four-Frequency Radar System installed in a WV-2 (Super Constellation) aircraft, BuNo 128324. This system is capable of transmitting and receiving four frequencies (P,X,L, and C) consecutively with a choice of horizontal, vertical, and alternating polarizations. The returns are gated at a fixed range and analyzed in a digital computer. Absolute clutter measurements have been taken over several sites at angles of incidence from 5 degrees to 60 degrees. The parameter measured was the normalized radar cross section in terms of the median value of its probability distribution. Data were obtained for this parameter as a function of incident angle, transmitted and received polarization, and radar wavelength for a wide variety of terrain types such as desert, mountainous, urban, and water. A significant conclusion was that the wavelength dependence of the terrain clutter varies from n = 0 for urban terrain to n = 3/2 for marshes. Author (TAB)

N69-17843*# ADCOM, Inc., Cambridge, Mass.

INVESTIGATION AND ANALYSIS OF TIME CODES Quarterly Report

6 Oct. 1967 166 p refs

(Contract NAS5-10540)

(NASA-CR-73954; G-110) Avail: CFSTI CSCL 17B

The basic considerations for establishing an optimum time code system concept are studied. The overall requirements for time code system definition are divided into: (1) transmission link design (baseband waveform, modulation/demodulation technique, baseband waveform regeneration at receiver); (2) coder-decoder design (for efficient time data encoding and transmission error control); and (3) recording and processing to meet individual user requirements. For convenience in the identification of the signal design and transmission problems, the time code transmission and distribution channels are classified on the basis of the range or seperation between source (or transmitter) and user (or receiver). The channel characteristics that affect timing signal transmission accuracy are then identified as: fading statistics, frequency response characteristics, coherence bandwidth, and fading rate. These channel characteristics are then shown to affect the selection of time code waveform, signal modulation, and receiver processing of time-code signals. A summary of essential transmission characteristics is presented for the wireline, line of sight and beyond the horizon tropo channels for the various link lengths of interest in time code transmission. Signal design for binary time code representation is considered. Author

N69-17868*# Communication Systems, Inc., Falls Church, Va.

PROCEEDINGS OF THE GEOS PROGRAM REVIEW MEETING. VOLUME 3: TRACKING INTERCOMPARISON TESTS WITH GEOS-1

John Berberet Feb. 1968 391 p refs Proc. held in Washington, 12-14 Dec. 1967

(Contract NASw-1503)

(NASA-CR-73959) Avail: CFSTI CSCL 17H

A series of technical papers is presented on the tracking intercomparisons using the optical and electronic subsystems on the GEOS 1. The use of the long arc orbital solutions and the GEOS Data Adjustment Program, and the determination and evaluation of the Goddard Range and Range Rate (GRARR) system are emphasized. Intercomparisons are given of Minitrack and Optical Tracking, GRARR, and SECOR networks. Improved coordinates for the MADGAR site are estimated. A short arc optical survey is also given, and variations in the mathematical modeling are discussed. Collocation experiment and refraction correction intercomparisons are mentioned. N.E.N.

N69-17950 Cornell Univ., Ithaca, N. Y.
THE DESIGN OF RADAR SIGNALS BY NONLINEAR PROGRAMMING
Edwin Bryce McCrohan, III (Ph.D. Thesis) 1968 235 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.05 Order No. 68-9443

The limiting resolution of a radar to detect targets separated in range and range rate is determined by the structure of the transmitted signal and receiver impulse response. The radar ambiguity function is a measure of that resolution. The numerical design of radar signals by repeated analysis of the ambiguity function is the subject of this investigation. Integral performance indices for a generalized moment and normalized, mean square clutter are defined. The minimization of these performance indices subject to inequality constraints on receiver efficiency and peak clutter-to-signal ratio is shown to be a type of general nonlinear programming problem. The constrained minimization is transformed into a sequence of unconstrained minimizations by the introduction of penalty functions. The unconstrained minimizations are then solved by the method of conjugate directions. Dissert. Abstr.

N69-17990 *# TRW Systems Group, Redondo Beach, Calif.
APOLLO LM AND CSM S-BAND ANTENNA TRACKING STUDIES. CSM-HGA INTERCHANGEABILITY STUDY ERROR ANALYSIS OF THE MONOPULSE COMPARATORS
Robert L. Fogel 18 Dec. 1968 48 p refs
(Contract NAS9-8166)
(NASA-CR-92491; TRW-11176-H101-R0-00) Avail: CFSTI CSCL 22B

This report contains an analysis of the narrow beam and wide beam comparators used in the CSM high gain antenna tracking system. The analysis is in support of the CSM high gain antenna interchangeability study, and its purpose is to determine the errors in the comparators caused by tolerance build-up during manufacturing and assembly and by temperature effects on the comparators. These errors are then used in the system mathematical model to determine their effect on the system transfer function and thus upon interchangeability. Author

N69-17994 *# Lockheed Electronics Co., Houston, Tex. Houston Aerospace Systems.
RESPONSE OF A CASCADE CONNECTED LIMITER AND PHASE DETECTOR TO PM SIGNALS
J. C. Chang 1 Nov. 1968 51 p refs
(Contract NAS9-5191)
(NASA-CR-99507; HASD-822229) Avail: CFSTI CSCL 17B

The response of a cascade connected limiter and phase detector to phase modulated signals are reported. Output signal to noise expressions are derived for sinusoidal modulating signals and phase modulated subcarriers. Two computer programs have been prepared to calculate the SNR transfer characteristics for the specific PM signals. The computed results are plotted to predict the performance of the cascade connection. Different modulation indices are considered in evaluating the performance of the product type phase detector. Author

N69-18029# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRANSISTORIZED PORTABLE TELEVISION CAMERA UNIT
Liu Yao Chi et al 9 Feb. 1968 9 p refs Transl. into ENGLISH from Ch'ing Hau Ta Hsueh Hsueh Pao (Peking), v. 12, no. 3, 1965 p 73-75
(AD-679716; FTD-HT-23-698-67) Avail: CFSTI CSCL 17/2

The article describes transistorized television transmitting equipment consisting of a portable TV camera and a backpack components cabinet. The camera consists of a photoconductive camera tube, a focusing coil, a deflecting coil, a feeder circuit, and a preamplifier weighing 2.5 kg, and the backpack weighs 16.5 kg and consists of a VHF TV transmitter, a synchronizer, horizontal and vertical sweep circuits, and a power supply unit. The picture signal taken by the television camera is transmitted by the VHF transmitter to the television station through a microwave television relay truck. Distance between transmitter and truck may be 4 km. The transmitter operates on a frequency of 199.25 mc at an output power higher than 5 w. A folded dipole antenna having an input impedance of 75 ohm is used. Two inverters supply the positive and negative high voltages to the camera tube and the transmitter. The input power for the two inverters is supplied by 14 silver-zinc batteries, which have a capacity of 20 amp-hr and can maintain transmitter operation for 4 hours continuously. The total power consumption of the equipment is 45 w. The TV receiver mounted on the relay truck has an overall receiving sensitivity up to 50 microvolts and a noise factor below 8 db and is almost identical with a conventional TV receiver. TAI

N69-18073 *# Lockheed Electronics Co., Houston, Tex.
THE RESPONSE OF H-LIMITING BAND PASS LIMITERS TO PM SIGNALS
J. C. Chang 22 Oct. 1968 31 p refs
(Contract NAS9-5191)
(NASA-CR-99506; HASD-822228) Avail: CFSTI CSCL 17B

The output signal to noise ratio of a hard-limiting bandpass limiter is calculated for a phase-modulated signal. A direct approach using first order statistics of the random phase variable is employed for all input SNR levels. The computer program and the calculated results are given in this report. The resulting limiter SNR transfer characteristics are in close agreement with Blachman's result. Author

N69-18077 Cornell Univ., Ithaca, N. Y.
DESIGN AND ANALYSIS OF MAXIMUM: A POSTERIORI RECEIVERS FOR NOISE MODULATION
Howard Allen Bodner (Ph.D. Thesis) 1968 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-9432

This thesis specifically treats the use of random noise, whose power is centered about a sufficiently high center frequency, as a carrier. Two forms of noise modulation are defined, amplitude and phase noise modulation, with direct analogies to deterministic amplitude and phase modulation. In order to design receivers for noise modulated signals distorted by additive noise, the noise modulation schemes are placed into the framework of previously done work on randomly-time-varying channels with deterministic modulation inputs. This analytical approach results in the design equations of the optimal receivers in the maximum a posteriori, MAP, sense for the noise modulated signal in the presence of additive noise. These equations then simplify into recognizable circuit elements for noise phase modulation if the additive noise is white. The equations do not reduce for noise amplitude modulation, however, and therefore are not treated further. Dissert. Abst.

N69-18174 *# TRW Systems Group, Redondo Beach, Calif.
AN INVESTIGATION OF THE MULTIPATH PROBLEMS ASSOCIATED WITH THE APOLLO CSM AND LM S-BAND HIGH GAIN COMMUNICATION ANTENNA TRACKING SYSTEMS
Jimmie D. Osborn and Michael D. Zuteck 16 Dec. 1968 59 p refs
(Contract NAS9-8166)
(NASA-CR-92497; TRW-11176-H085-R0-00) Avail: CFSTI CSCL 22B

The effects of multipath interference on the operation of the Apollo S-band command service module-high gain antenna and lunar module steerable antenna tracking systems are evaluated. Radio frequency reflections from each spacecraft and the lunar surface are considered the primary sources of multipath interference

The operation of the antennas, in both the docked and undocked vehicle configurations, in the presence of multipath is discussed. Error curves have been generated for each antenna system that show the type and amount of degradation that will occur, and a simple antenna pattern measuring technique is suggested that allows the error curves to be used to determine the magnitude of the multipath problem resulting from spacecraft reflections. The effects of lunar reflections while the vehicles are in lunar orbit and during LM descent and ascent are discussed. Methods for reducing the effects of spacecraft reflections upon the operation of the antenna systems are also discussed. Author

N69-18192*# TRW Systems Group, Redondo Beach, Calif.
LM AND CSM S-BAND ANTENNA TRACKING STUDIES. ELECTRONICS ASSEMBLY INTERCHANGEABILITY STUDY. VOLUME 1: SMALL SIGNAL ANALYSIS
L. H. Robinson, Jr. 13 Dec. 1968 66 p refs
(Contract NAS9-8166)
(NASA-CR-92439; TRW-11176-H087-R0-00-Vol-1) Avail: CFSTI CSCL 22B

This report describes the linear, small signal characteristics of the electronics assembly input/output transfer functions. These estimates are based on parameter data. Also described are the electronics assembly switching logic functions at the equivalent circuit level and estimates of the nominal and worst-case limits of the analog threshold functions. Overall switching functions are reduced to equivalent Boolean logic equations and typical operational sequences of events are described. The analyses presented are based on a linear model of the SCM high gain antenna tracking system, where saturation and other non-linearities have been neglected. Thus, the results presented are valid only for small tracking errors, up to about ±0.1 degrees or less. Author

N69-18195*# TRW Systems Group, Redondo Beach, Calif.
APOLLO LM AND CSM S-BAND ANTENNA TRACKING STUDIES. CSM-HGA INTERCHANGEABILITY STUDY ANTENNA AND RF CIRCUITRY ANALYSIS
Jimmie D. Osborn 2 Dec. 1968 37 p refs
(Contract NAS9-8166)
(NASA-CR-99500; TRW-11176-H080-R0-00) Avail: CFSTI CSCL 22B

The purpose of this report is to present a mathematical model of the RF portion of the Apollo high gain antenna and to outline an approach to determining the interchangeability of CSM-HGA RF subsystems. Since the output of a sequentially lobed antenna system is an amplitude modulated voltage whose index of modulation is a function of the space angle, the antenna parameters that determine interchangeability are boresight alignment and variation in index of modulation from unit to unit. The index of modulation slope near the antenna boresight is referred to as antenna transfer function or antenna gain constant. A mathematical model of the RF system has been developed for the purpose of isolating critical circuit components and predicting RF boresight shift and index of modulation variations caused by manufacturing tolerances and temperature differentials. The model is also used to predict the effects of crosstalk between wide and narrow beam modes. Interchangeability is determined by the accuracy of the test procedures combined with the boresight shift and variation in index of modulation caused by temperature differentials in the operational environment. Author

N69-18203#
TELEVISION APPARATUS FOR SCIENTIFIC SPACE RESEARCHES
P. F. Bratslavets et al. [1968] 10 p refs Transl. into ENGLISH from Tekhn. Kina i Televideniya (Moscow), no. 10, Oct. 1968 p 18–23
Avail: CFSTI

Three types of systems and transmission apparatus are considered for application in space research: the single-element system, and two systems with film accumulation, i.e., the low-frame electronic vidicon system, and the photo television system. Specifics of design, advantages, and operational problems of these systems are compared. K.W.

N69-18248# Illinois Univ., Urbana. Aeronomy Lab.
FEASIBILITY STUDY FOR A THOMSON SCATTER RADAR ANTENNA
J. V. Evans, ed. Nov. 1968 380 p refs *Its* Aeronomy Rept. No. 25
(Grant NSF G-1048)
Avail: Issuing Activity

A number of engineering studies were made by industrial companies with the objective of determining the feasibility and cost of constructing a 100 m diameter Thomson radar scatter antenna facility. It was concluded that the cost of the complete antenna (i.e. including drives, servo control and all access equipment) will be in the region of $16.5 million, and will not change significantly if the antenna is enclosed in a metal space frame radome or not. However, the performance (in particular the pointing precision) will be decidedly inferior and at times outside the specifications for the exposed antenna during windy periods. The objectives were set for the feasibility studies: the feasibility and the cost should be established to ±25% of the radome enclosed and environmental antennas, constructed to meet certain specifications which are enumerated. All contributions to the pointing error budgets, including the gust induced servo errors, were analyzed. Separate reports are included for specific problems considered. B.P.

N69-18259# Naval Research Lab., Washington, D. C. Communications Sciences Div.
FREQUENCY MONITORING SYSTEM FOR USS NIMITZ
D. A. Venn and M. R. Webb *In its* Rept. of NRL Prog. Dec. 1968 p 1–4 refs (See N69-18258 07-34)
Avail: CFSTI

A frequency monitoring system (FMS) and a Central Time and Frequency Control (CTFC) facility to provide monitoring and control functions for communication networks is described. With the FMS, an operator can monitor multiple transmitters and receivers. The CTFC provides the communication complex with precision frequencies of 100 kHz, 1 MHz, and 5 MHz. The FMS and the CTFC will be installed in the USS NIMITZ, for operational evaluation. Sixteen transmitters and 35 receivers will be monitored by the FMS in this application. Author

N69-18267# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON THE THEORY OF MAGNETOIONIC PROPAGATION IN THE EARTH'S MAGNETOSPHERE
Eugène A. Graham 1968 41 p refs Presented at the Intern. Symp. on Wave Propagation, Stresa, Italy, 24–29 Jun. 1968 Submitted for publication
(ONERA-TP-593) Avail: CFSTI

Magnetoionic propagation of signals and geophysical phenomena are investigated. A theoretical treatment of such propagation has been made, starting with Maxwell's equations and comprising the tensor quantities of interest. These tensor quantities are linked with the Hall, the transverse (or Pedersen), and the longitudinal conductivities, considering the plasma effectively 'cold'. From this, incidentally, one arrives at a form of the Appleton-Hartree equation, in terms of said conductivity tensor, in addition to added insights due to such linking of ideas. Special account is taken of the new knowledge garnered by the artificial instrumentalized satellites of the last ten years and, particularly, of the last five years. Hamiltonian ray theory and its application to high speed digital computers are treated with some interesting results. Specifications are made in the study of geophysical anomalies. Author (ESRO)

N69-18271 Cornell Univ., Ithaca, N. Y.
THE USE OF A DIVIDED-BAND AMPLIFIER AS A SELF-ADAPTING OPTIMUM COMMUNICATION SYSTEM
Charles D. Seligson (Ph.D. Thesis) 1968 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-9447

A divided-band amplifier, DBA, is considered in applications which require a network with an adjustable frequency response. The DBA which is used has a frequency response whose amplitude characteristic can be readily altered by changing the gains of the individual amplifiers making up the DBA. The use of the DBA as an infinite-lag smoothing filter utilizes the ability of the DBA to extract spectral information from an input signal and thus avoid separate estimation of power density spectra. A control system is suggested which, after changes in the noise power spectrum, automatically adjusts the DBA response so that the conditions resembling an optimum system are maintained at all times. Dissert. Abstr.

N69-18289#
STATISTICAL APPROACH TO THE PROBLEM OF SIGNAL DETECTION IN INTERFERENCE AND OPTIMAL DETECTION CRITERION
V. B. Pestriakov [1968] 5 p Transl. into ENGLISH from the book "Fazovye Radioteknicheskie Sistemy" Moscow, Sov. Radio Press, 1968 p 202-207
Avail: CFSTI

The statistical, probabilistic approach to the signal detection problem is examined from the viewpoint of checking or testing statistical hypotheses. It is pointed out that the processing rule and algorithm should be embedded in the receiver-display, in its circuit, and operating principle. Based on the information obtained, one of the alternative hypotheses must be selected. The types of errors which accompany the solution are defined, and the question of the optimality criterion is considered. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-17222# California Univ., Berkeley. Lawrence Radiation Lab.
DESIGN AND USE OF DATA LINK FOR HIGH ENERGY PHYSICS EXPERIMENTS
Sypko W. Andreae, Robert W. Lafora, and Frederick A. Kirsten 31 Jul. 1968 10 p Presented at Intern. Symp. on Nucl. Electron. Versailles, France, 10-13 Sep. 1968
(Contract W-7405-ENG-48)
UCRL-18181; CONF-680906-1) Avail: CFSTI

The use and operating characteristics of a data link between small on-line computers (PDP-5's) and a large batch-processing computer (Control Data 6600) is described. This link was constructed to permit access to the large central computer during the operation of high-energy physics experiments. This access allows the processing of portions of the experimental data on a nearly-time basis. Certain design restrictions were imposed by the nature of the CDC 6600 and its normal mode of use. Author (NSA)

N69-17292# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
INTERFACE BETWEEN EXPERIMENTAL NUCLEAR INSTRUMENTATION AND THE CONTROL SYSTEM [INTERFACE TRA STRUMENTAZIONE PER ESPERIENZE NUCLEARI E SISTEMA DI CONTROLLO]
L. Babiloni, S. Bevilacqua, and E. de Agostino 1968 24 p ref in ITALIAN
(RT/EL(68)8) Avail: CFSTI

An interface system, designed in order to join nuclear instrumentation and control system, is described. This interface has been realized in view of its use in connection with a special purpose controller, but some special criteria adopted in its design will make it suitable for many other different automation problems, including general purpose computers. Author (NSA)

N69-17334# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIAL-PURPOSE COMPUTER FOR MINIMIZATION OF LOGIC FUNCTIONS
B. L. Timofeyev 12 Jan. 1968 8 p refs Transl. into ENGLISH from the book "Mezhdunarodnyi Simpozium Po Teorii Releinykh Ustroistv i Konechnykh Avtomatov (Ilfak). Sintez Releinkh Strucktur. Trudy Simpoziuma" Moscow, Nauka, 1965 p 337-341
(AD-679728; FTD-HT-23-1274-67) Avail: CFSTI CSCL 9/2

The Institute of Automation and Telemechanics is engaged in the development of a desk-type special-purpose computer for minimization of Boolean functions of 4-6 variables which are in canonical disjunctive form. The algorithm to be utilized was proposed by M. A. Gavrilov. This algorithm is an ordered procedure for minimizing a function of 10-12 variables in a given time limit. A prototype of one part of the computer (solving for implicants of a given function) is already made. Author (TAB)

N69-17338 Washington Univ., St. Louis, Mo.
A SUBOPTIMAL METHOD FOR THE GLOBAL SOLUTION OF THE NONLINEAR PROGRAMMING PROBLEM
Richard Michel Hesse, Jr. (Ph.D. Thesis) 1968 181 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-10754

A method is developed for the solution of nonlinear programming problems that will automatically and systematically search for a better solution. First a penalty function is developed that will allow an automatic search in both the feasible and infeasible region. Sufficient conditions on certain parameters are given that will ensure convergence of the penalty function. Secondly, a method to reduce the right hand side of certain active constraints is employed and the advantage and limitations of this technique are discussed. By reducing certain constraints (parallel cuts) the local optimum is made infeasible and the penalty function can be employed again to gain feasibility. The new local optima are stored and used as starting points for continuation of the search for a global solution to the original problem. It is shown that this technique may not lead to a global optimum. Dissert. Abstr.

N69-17371 Washington Univ., St. Louis, Mo.
THE BOUNDED VARIABLE ALGORITHM FOR SOLVING INTEGER LINEAR PROGRAMMING PROBLEMS
Patrick Dennis Krolak (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-10795

This thesis will report on a new method for solving a general integer linear programming problem which is called the Bounded Variable Algorithm. It will include a description of the algorithm and some additional information about the actual computer program. A comparison of limited scope will be made between the Bounded Variable Algorithm and other published algorithms on a set of common problems. Extensions will also be discussed of the Bounded Variable Algorithm to the discrete programming problem, the mixed integer problem, the fixed charge problem, and a class of nonlinear problems. The possibility of modifying the algorithm into an effective heuristic will also be discussed. Dissert. Abstr.

N69-17388# Atomic Energy Commission Research Establishment, Riso (Denmark).
CONTROL INTERFACE SYSTEM FOR EAI 680- PDP 8
K. Soee Hoejberg and Chr. Suusgaard Jun. 1968 15 p
(RISO-M-768; R-22-68) Avail: CFSTI

The control interface system described is primarily intended for the automatic potentiometer setting in the analog computer EAI 680 from the 12-bit digital computer PDP 8. NSA

N69-17399# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
SOME TECHNIQUES FOR ALGORITHM OPTIMIZATION WITH APPLICATION TO MATRIX ARITHMETIC EXPRESSIONS
Robert Alan Wagner (Ph.D. Thesis) Jun. 1968 162 p refs
(Contract F44620-67-C-0058)
(AD-678629; AFOSR-68-2641) Avail: CFSTI CSCL 9/2

Algorithm optimization can be accomplished by an exhaustive search over alternative algorithms for performing some programming task. The resulting algorithms are optimum only with respect to a program technology--the particular set of alternatives investigated. Thus, larger program technologies can be expected to yield better algorithms. This thesis contributes to the production of optimum algorithms in two ways. First, a technique (loop-fusion) was developed for producing new algorithms equivalent to old algorithms, and thus expanding program technologies. Second, a technique (comparison) is described which reduces the effort required by certain exhaustive searches over well-structured search spaces. These techniques are applied to the production of algorithms for evaluating matrix arithmetic expressions (MAE). (The operators, + and *, in such arithmetic expressions are interpreted as matrix addition and multiplication, respectively.) A method is described for producing, for any MAE, an algorithm for its evaluation which requires fewest arrays for holding N by N matrices, while not requiring more execution time than the standard MAE evaluation algorithm. Although the algorithm-production method used is basically an exhaustive-search over a large space of program alternatives for each subexpression of the given MAE, the effort this method requires grows only linearly with the number of operators in the given expression. Author (TAB)

N69-17409*# Martin Co., Denver, Colo.
DEVELOPMENT OF SSB/DSB AUXILIARY TIME DIVISION MULTIPLEXER AND DEMULTIPLEXER Final Report, 14 Jun. 1967–19 Feb. 1968 57 p
G. O. Olson and R. O. Leighou Feb. 1968 57 p
(Contract NAS8-21164)
(NASA-CR-98307; MCR-68-57) Avail: CFSTI CSCL 09B

This report describes the results of the development contract for an SSB/DSB auxiliary time division multiplexer prototype and a demultiplexer breadboard. The multiplexer time multiplexes up to 80 subchannels into 20 channels and provides a pseudo ransom sync code. The demultiplexer uses the pseudo random sync code to demultiplex any 3 channels into the original subchannels and provides identification for the time each subchannel is active and a sync code error signal. Author

N69-17428 Catholic Univ. of America, Washington, D. C.
AUTOMATIC EQUALIZATION OF DISPERSIVE CHANNELS FOR HIGH SPEED DATA TRANSMISSION
Wilford Rabon Poe (Ph.D. Thesis) 1968 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-9255

Results are presented of a study of automatic equalization of narrow band dispersive channels for high speed data transmission. A time invariant, low-pass equivalent model for a vestigial-sideband multilevel modem operating through a voice bandwidth telephone channel is developed. The optimum detector for the model, based on the criterion of simultaneously minimizing the effects of ambient noise and intersymbol interference, is shown to have the form of a matched filter followed by transversal filter. The problem of determining the proper tap weight gains for the transversal equalizer is investigated and found to be equivalent to that of solving a set of simultaneous linear equations. A general steepest descent method of solution to the set of linear equations is obtained. Four different iteration rules are derived from the general rule and are extensively simulated on a digital computer. A laboratory modem with an automatic equalizer based on the simplest of the four iteration rules was constructed. Results of signaling at data rates of 4800 and 7200 bits per second over several voice bandwidth channels are presented. Dessert. Abstr.

N69-17447# California Univ., Los Angeles. Dept. of Engineering.
A PROBLEM ORIENTED LANGUAGE AND A TRANSLATOR FOR PARTIAL DIFFERENTIAL EQUATIONS
A. F. Cardenas Nov. 1968 263 p refs
(Contracts AT(11-1)-GEN-10; Nonr-233(52); ARPA SD-184; Grant NSF-GK-1758)
(AD-679725; UCLA-10P14-61; Rept-68-62) Avail: CFSTI CSCL 9/2

No high level problem oriented computer language is available to study and solve continuous systems characterized by partial differential equations; furthermore, conventional methods to handle such problems on a computer are very time consuming. Therefore, two main goals are accomplished: (1) a convenient, easy to learn and to use, high level problem oriented language to solve and study partial differential equation problems is designed; and (2) a feasible translator for the language is designed, and a preliminary version of it is constructed for a significant portion of the language. The translator is written in preprocessor PL/1 and translates from PDEL into PL/1. The PL/1 program generated is then processed like any other PL/1 program. The implemented PDEL is as much on line as standard PL/1. The translator is machine independent and can be used in any machine with a standard PL/1 compiler. The main goal of the PDEL language and translator is to ease and speed up the total problem solving time, mainly by significantly reducing the programming effort - usually the largest portion of total problem solving time. Author (TAB)

N69-17480# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON A SYSTEM CHECK METHOD CONCERNING THE EXECUTION
Z. Sh. Kipshidze 17 Apr. 1968 13 p refs Transl. into ENGLISH from Tr. Vychislitelnyi Tsentr (Tiflis), v. 7, no. 2, 1966 p 53-59
(AD-679684; FTD-MT-24-105-68) Avail: CFSTI CSCL 9/2

A new method of checking computer operations is set forth which detects and corrects single errors and detects multiple errors. Conventionally, checking codes are represented by a remainder of the division of number x by modulus P; in the new method, the check information is derived from the digit weight. Positive numbers are used for checking. TAB

N69-17485# Illinois Univ., Urbana. Coordinate Science Lab.
CORRECTION OF SINGLE AND MULTIPLE BURSTS OF ERROR
Lalit Rai Bahl Oct. 1968 67 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-2339)
(AD-679877; R-397) Avail: CFSTI CSCL 9/4

Error statistics studies on information transmission and storage channels have shown that in many cases error patterns occur as relatively short multiple bursts within a single codeword. A systematic method for constructing codes to correct such error patterns is presented. A detailed analysis is made for a class of cyclic codes capable of correcting one long burst or two relatively shorter bursts of errors. Lower bounds are calculated for the error

correcting capabilities of these codes. Decoding methods are also discussed. A direct generalization of these codes provides a method for constructing codes to correct an arbitrary number of bursts of errors. The application of threshold decoding techniques to these codes is discussed. It is shown that these codes can be considered as the multi-dimensional cyclic product of a number of even parity check codes. The multidimensional geometric structure of these codes is investigated. Author (TAB)

N69-17493# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECIAL PURPOSE ANALOG COMPUTERS ASSEMBLED FROM STANDARD MODULES

V. I. Ogurtsov 3 Apr. 1968 13 p refs Transl. into ENGLISH from Akad. Nauk UzSSR, Inst. Kibernetiki i Vychislitelnyy Tsentr. Vopr. Kibernetiki i Vychislitelnoy Mat. (USSR)

(AD-679521; FTD-HT-23-143-68) Avail: CFSTI CSCL 9/2

Generally, any linear or nonlinear analog computer consists of three principal units: power-supply unit, solver, cathode-ray tube display. Modular units of this kind are being manufactured by the Soviet industry. Thus, the UESV-1 type power-supply unit is designed to power unified operational amplifiers UU-1 and UU-3 which serve to construct various solving units: adders, scalers, integrators, inverters, multipliers and others. The cathode-ray tube displays most often used in analog computers are those of the 1-4 and 1-5 types both designed for visual observation of the process on the cathode-ray tube screen. The three principal units can be used along with various accessories to construct special purpose linear and nonlinear analog computers containing from 20 to 500 operational dc amplifiers and designed for the solution of problems described by ordinary linear and nonlinear differential equations, partial differential equations and algebraic equations and their cost is relatively low compared with the cost of serially manufactured analog computers. Author (TAB)

N69-17495# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A COMPARATIVE ANALYSIS OF REDUNDANCY TO INCREASE THE RELIABILITY OF INFORMATION SYSTEMS

G. P. Beznosov et al 4 Apr. 1968 15 p refs Transl. into ENGLISH from Akad. Nauk. Tr. Sibirskoye Otd. Inst. Avtom. i Elektr. (USSR)

(AD-679506; FTD-HT-23-146-68) Avail: CFSTI CSCL 9/2

Various methods of using redundancy for enhancing reliability of information systems are analyzed and compared. The mean time between failures is adopted as a single criterion of system reliability. Assumptions are system operation and failures permit describing the system by a simple uniform Markov chain with a finite number of states. The system states are determined by possible combinations of faulty and sound elements. TAB

N69-17500# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FAST PULSE SIGNAL AVERAGING

W. E. Wilson Aug. 1968 26 p refs

(Contract AT(45-1)-1830)

(BNWL-868) Avail: CFSTI

A system which couples a sampling oscilloscope with a small digital computer is described. This combination makes it possible to digitally record very high frequency (up to 1GHz) and low-level (down to mV) electronic waveforms. By having the data in digital form in a computer, it is possible to do elementary calculations on individual waveforms or process many repetitions of a waveform (signal average). Some familiarity with sampling techniques and digital computers is assumed. Author (NSA)

N69-17521# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

USING THE ADDRESS LANGUAGE TO AUTOMATE SYNTHESIS OF DIGITAL COMPUTERS

I. V. Ilovayskiy et al 29 Mar. 1968 48 p refs Transl. into ENGLISH from Vychisliter'naya Sistemy (USSR), no. 18, 1965 p 34-71

(AD-679519; FTD-HT-23-1524-67) Avail: CFSTI CSCL 9/2

One of the possible methods of automating the synthesis of the symbolic circuit of digital computers on the basis of a specified system of instructions is considered. An algorithm (A) for transition from the recording of computer instructions in the address language to a symbolic circuit in the form of a system of logic equations is proposed. The starting premise for constructing A is the condition of the performance of all the instructions by a single device. A applies to the construction of the symbolic circuits of computers for which the following starting characteristics are specified: number of memory elements; capacity of each memory element and method of access; method of presentation of numbers, format of numbers; addressability; method of presentation of modified instructions; system of instructions; principle of organization of the time flowchart; duration of every operation, expressed in conditional units. The operation of A is illustrated by describing the synthesis of an elementary computational system. Author (TAB)

N69-17548# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POSSIBILITIES OF ENHANCING THE RELIABILITY OF DISCRETE COMPUTING AND CONTROL DEVICES

V. B. Svechinskiy 29 May 1968 14 p refs Transl. into ENGLISH from Tr. Energ. Inst. (Moscow), no. 59, 1965 p 245-252

(AD-679793; FTD-HT-23-56-68) Avail: CFSTI CSCL 9/2

The problem of constructing a high-reliability automaton reduces to the following: given a structurally complete system of functional elements as well as transition and output tables of a discrete-action automaton, construct a self-correcting discrete-action s-rank automaton from elements of this system. The rank of the automaton is taken as the maximum number of any elements that may malfunction without disturbing the automatons performance. It is shown that an increase in the rank leads to an increase in reliability. The synthesis of an automaton of the rank 1 is examined. TAB

N69-17580# Illinois Univ., Urbana. Coordinated Science Lab.

CYLINDERS: A DATA STRUCTURE CONCEPT BASED ON RINGS

P. Weston and S. M. Taylor Sep. 1968 42 p refs

(Contract DAAB07-67-C-0199)

(AD-679946; R-393) Avail: CFSTI CSCL 9/2

The report is designed to be of use as both a reference manual for Cylinder programming and as a more general introduction to the linked-list notions upon which CYL6, our Cylinder system, is based. Accordingly, it is divided into two major sections, the second being a detailed manual for the CYL6 routines, the first containing only more general description. Because the rate of change of CYL6 is not yet absolutely zero, this report must be considered as a provisional description of it. Author (TAB)

N69-17627# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYSTEM OF TRANSMITTING INFORMATION BETWEEN DIGITAL AND ANALOG (D/A) COMPUTERS

V. V. Klimov and Ya. U. Kovalin 9 Feb. 1968 9 p refs Transl. into ENGLISH from Vses. Konf.-Seminar Teorii Metodam Mat. Modelirovaniya, Tr. (Kiev), 4th, 1964

(AD-679809; FTD-HT-23-1191-67) Avail: CFSTI CSCL 9/2

When investigating automatic control systems, the necessity originates for complex utilization of analog AVM and digital TSVM

computers. To unify the computers in a complex system, an information transmission system can be used, consisting of a multichannel analog-digital ATSP transformer, multichannel digital-analog TSAP transformer and a UU control device. Author (TAB)

N69-17648# Aerospace Corp., San Bernardino, Calif. San Berardino Operations.
TWO COMPUTER PROGRAMS FOR THE PERSPECTIVE REPRESENTATION OF CURVES AND SURFACES Technical Report, Jan. 1964-Jul. 1968
Bruce R. Kubert Sep. 1968 290 p refs
(Contract F04701-68-C-0200)
(AD-679626; SAMSO-TR-68-434) Avail: CFSTI CSCL 9/2

The report describes a procedure whereby an arbitrary continuous single valued function of two variables of bounded variation can be represented as a perspective drawing. An algorithm for the exclusion of hidden surfaces is included. Two computer programs utilizing this procedure are given. Author (TAB)

N69-17718# Dartmouth Coll., Hanover, N. H. Mathematics Dept.
SLAMS: SIMPLIFIED LANGUAGE FOR ABSTRACT MATHEMATICAL STRUCTURES
Neal Weidenhofer (Ph.D. Thesis)
Jun. 1968 92 p refs
(Contract F44620-68-C-0015)
(AD-679603; AFOSR-68-2325) Avail: CFSTI CSCL 9/2

For many years the only programming languages available were machine languages and languages in the class with FORTRAN. LISP and the list processing languages then came on the scene with several new and powerful capabilities. With the new capabilities, came a new syntax that, although powerful and flexible, is difficult for the novice to master. SLAMS is an attempt to combine the simpler syntax of the FORTRAN class languages, in particular, BASIC with some of the capabilities of the list processing languages. This paper gives a broad description of the use of SLAMS along with some of the examples that contributed to its design. The current, experimental, implementation on the Dartmouth GE-635 Time-Sharing System is also described. Author (TAB)

N69-17722# C-E-I-R, Inc., Washington, D. C.
SYSTEM AND SOFTWARE SIMULATOR, VOLUME 1
Leo J. Cohen Dec. 1968 281 p refs
(Contract DA-49-083-OSA-3306)
(AD-679269) Avail: CFSTI CSCL 9/2

The System and Software Simulator (S3) is a digital event simulator written in FORTRAN IV and designed to perform simulations of computer systems hardware and software and of the workload being applied to the system. This and the other three volumes constitute the complete documentation available on S3. Volume I describes the inputs, outputs, methods and capabilities of S3. Author (TAB)

N69-17723# C-E-I-R, Inc., Washington, D. C.
SYSTEM AND SOFTWARE SIMULATOR, VOLUME 2
Leo J. Cohen Dec. 1968 456 p
(Contract DA-49-083-OSA-3306)
(AD-679270) Avail: CFSTI CSCL 9/2

The System and Software Simulator (S3) is a digital event simulator written in FORTRAN IV and designed to perform simulations of computer systems hardware and software and of the workload being applied to the system. This and the other three volumes constitute the complete documentation available on S3. Volume II contains the flow charts, narrative description of the flow charts, layouts and descriptions of the tables utilized by S3. Author (TAB)

N69-17724# Cohen (Leo J.) Associates, Inc., Trenton, N. J.
SYSTEM AND SOFTWARE SIMULATOR, VOLUME 3
Leo J. Cohen Dec. 1968 249 p
(Contract DAAB09-68-C-0118)
(AD-679271) Avail: CFSTI CSCL 9/2

The System and Software Simulator (S3) is a digital event simulator written in FORTRAN IV and designed to perform simulations of computer systems hardware and software and of the workload being applied to the system. This and the other three volumes constitute the complete documentation available on S3. Volume III contains descriptions of the assembly language used for preparation of input to S3, of the macro capability of the assembler, and of the modifications made to S3 to provide additional output data. Author (TAB)

N69-17725# Cohen (Leo J.) Associates, Inc., Trenton, N. J.
SYSTEM AND SOFTWARE SIMULATOR, VOLUME 4
Leo J. Cohen Dec. 1968 430 p
(Contract DAAB09-68-C-0118)
(AD-679272) Avail: CFSTI CSCL 9/2

The System and Software Simulator (S3) is a digital event simulator written in FORTRAN IV and designed to perform simulations of computer systems hardware and software and of the workload being applied to the system. This and the other three volumes constitute the complete documentation available on S3. Volume IV is the program documentation on the internal workings of the assembler. It consists of table descriptions, flow charts and narratives, and file descriptions. Author (TAB)

N69-17759# Commerce Dept., Washington, D. C. Office of State Technical Services.
COMPUTERS: SELECTED BIBLIOGRAPHIC CITATIONS ANNOUNCED IN US GOVERNMENT RESEARCH AND DEVELOPMENT REPORTS, 1968
Mar. 1968 90 p refs
(STS-108; PB-180137) Avail: CFSTI CSCL 09B

The bibliography consists of abstracts of reports on computers and related subjects which were announced in U. S. Government Research and Development Reports during 1968. USGRDR

N69-17761# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELIABILITY OF MAGNETIC TAPE MEMORIES
A. A. Kilna 4 Apr. 1968 15 p refs Transl. into ENGLISH from Akad. Nauk Lit SSR, Tr. Ser. B, Fiz.-mat., Khim., Geol. i Tekhn. Nauki (USSR), no. 3, 1966 p 191-200
(AD-679508; FTD-HT-23-148-68) Avail: CFSTI CSCL 14/3

By lumping together noise associated with magnetic tape quality, inherent noise of signal processing circuits, and noise caused by mechanical sources such as flutter and tape-head channel crosstalk, the author expresses the reliability of digital tape readers as a function of probabilities of misreading 0 and 1. Assuming that noise follows a normal distribution pattern, the author shows that the probability of tape reader failure is a function of discriminator-threshold-level discerning between 0 and 1, and that this probability has a minimum and maximum value. A probability of failure for reading a random code is derived. These results are used to evaluate the reliability of the BESM-2M computer tape memory system. A method for finding the actual distribution of signal and noise amplitudes in this system is presented. TAB

N69-17767# Dabcovich and Co., Inc., Lexington, Mass.
THE OSO-3 SOLAR ULTRAVIOLET DATA ANALYSIS PROGRAM. PART 1 Final Report, Feb. 1967-Aug. 1968
Frona B. Vicksell Nov. 1968 80 p refs
(Contract F19628-67-C-0227)
(AD-679757; AFCRL-68-0570-Pt-1) Avail: CFSTI CSCL 3/2

This report describes the program written to process ultraviolet measurements from the OSO-III satellite. The logical procedures and the computations are explained and sufficiently detailed information is included to allow the user to set up computer runs. Author (TAB)

N69-17778# Laboratory for Electronics, Inc., Boston, Mass. Mass Magnetic Memory and Logic Development Dept.
RESEARCH IN FERROMAGNETICS Final Report, 15 Dec. 1966–15 Sep. 1968
Noubar Aghishian, Michael J. Marino, Zimri Putney, and John Veronelli Sep. 1968 208 p refs
(Contract F19628-67-C-0172)
(AD-679595; AFCRL-68-0531) Avail: CFSTI CSCL 9/2

The continued research and investigation of Domain Tip Propagation Logic (DTPL) was carried out under the program reported here. Improved logic and shift register devices were designed, implemented, tested and shown to perform according to expectations. On the basis of these studies, a final design for the magnetic thin film portion of a DTPL arithmetic unit is established. In addition, explanation is given about the results of experiments performed on the crossover element, punch-through diode, new DTPL AND gate, and modifiable logic element. A thorough investigation of planar Hall effect is carried on. This effect can be employed not only as a non-destructive readout technique, but also as a memory coupling element. Through the use of the magnetically controllable current produced by the Hall voltage a new property for use in memory devices is suggested. Furthermore, from the theoretical Hall effect dependencies, the planar Hall voltage is employed to measure several magnetic properties of thin films. The coercive force, anisotropy field, dispersion, skew, etc., are examples of magnetic properties measured from the Hall effect studies. In addition, improved methods for fabricating the Hall elements are studied and the Hall effect readout elements are produced. Various experiments show the effect of the domain tip introduced into the low coercive force channels. Finally, Domain tip velocity and other related subjects are described, stressing the importance of these subjects in the implementation of DTPL shift register. Author (TAB)

N69-17867 Case Western Reserve Univ., Cleveland, Ohio.
AUTOMATED FUNCTIONAL DESIGN OF DIGITAL SYSTEMS
Ernest August Franke (Ph.D. Thesis) 1967 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-10156

A computer aided design system for the functional design of digital systems was developed and evaluated. A user-oriented programming language, specifically tailored for non-stored program digital systems, was developed for describing the process flow chart of a system. Computer programs for simulating the system operation and producing the block diagram of the system were written. Several digital machines were described, simulated, and designed at the block diagram level, using the computer-aided design system. The specification of the language developed, a description of the computer programs for simulation and block diagram generation, an example design, and an evaluation of the computer-aided design system are presented. Dissert. Abstr.

N69-17873# California Univ., Los Angeles. Western Management Science Inst.
PRIMAL RESOURCE-DIRECTIVE APPROACHES FOR OPTIMIZING NONLINEAR DECOMPOSABLE SYSTEMS
Arthur M. Geoffrion Oct. 1968 85 p refs Submitted for publication *Its* Working Paper No. 141
(Grant NSF GP-8740)
(AD-679770) Avail: CFSTI CSCL 12/2

The study presents some new results on three primal-feasible computational approaches for optimizing a system composed of interrelated subsystems. The general structure treated is the same as the principal one of the classic paper by Dantzig and Wolfe, except that we permit convex nonlinearities provided that the overall criterion function and coupling constraints are separable by subsystem. Each approach decentralizes the optimization by iteratively allocating system resources to the subsystems, with each subsystem computing its own optimal utilization of the given resources at each iteration. The chief obstacle to centrally directing the resource allocation toward an overall optimum is that the optimal response of each subsystem, as a function of its allowed resources, is not available explicitly. A computationally practical procedure must therefore suitably approximate or generate the optimal response functions as needed. Author (TAB)

N69-17902# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME INFORMATION ON SOVIET ELECTRONIC COMPUTERS
A. Ye. Sazanov 20 May 1968 14 p Transl. into ENGLISH from Elektronnyye Vychislitel'nyye Mashiny i Sudovaya Avtomatika (Moscow), 1966 p 164–172
(AD-679794; FTD-HT-23-1585-67) Avail: CFSTI CSCL 9/2

This article gives a description of the capabilities of many Soviet electronic computers. (1) The UM-1NKH small control computer is designed for use in chemical, oil refining and metallurgical industries; (2) the TsUM-1 electronic digital control computer is designed to monitor and control production processes; (3) the Minsk-22 system is designed to solve both scientific-technical problems, as well as, economic-planning problems; and (4) the Promin electronic digital computer is designed for the automation of engineering and scientific calculations. Author (TAB)

N69-17925# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION OF AN EFFECTIVE SYSTEM OF DEPENDENT ATTRIBUTES
G. S. Lbov 8 Jan. 1968 14 p refs Transl. into ENGLISH from Vychislitelnye Sistemy (USSR), no. 19, 1965 p 21–34
(AD-679657; FTD-HT-23-1520-67) Avail: CFSTI CSCL 9/4

The report concerns a problem in the recognition of k patterns. Selection G, consisting of N sub 1 objects for the first pattern, N sub 2 objects for the second pattern, etc., is assigned for the training function. Each object of selection G is characterized by the realization of vector x = (x sub 1, ..., x sub n) from the initial criteria system. Known methods of solving the cited problem are reviewed and a study is made of an heuristic program of random search with adaptation, employing the Monte Carlo method. The approach is illustrated in terms of interpretation of ballistocardiograms. Author (TAB)

N69-17955# Atomic Energy Commission Research Establishment, Riso (Denmark).
MULTIPLE 4-QUADRANT MULTIPLIER; 1-QUADRANT MULTIPLIER
K. Soee Honjberg May 1968 8 p
(RISO-M-756; R-18-68) Avail: CFSTI

By means of the multiple 4-quadrant multiplier program a digital computer can be used as conventional analog multipliers. The operations performed are $z = xy$. $z_1 = x_1y_1 \ldots z_n = x_nv_n$. By means of the 1-quadrant multiplier program a digital computer can be used in a similar way as a conventional analog multiplier for the operation $z = xy$. NSA

N69-18008# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.
ELECTRONICS DEPARTMENT ACTIVITIES Quarterly Report, 1 Jan.–31 Mar. 1968 (BERETNING OM ARBEJDET I ELEKTRONIKAFDELINGEN

Jun. 1968 25 p refs In DANISH
(RISO-M-771; R-23-68) Avail: CFSTI

A summary is given of department activities: automatic recording of meteorological data, burnout meters, hybrid computer calculation (HDT), and automatic testing of data cards based on logic circuits. NSA

N69-18009# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.
PDP 8 MAGNETIC DRUM TEST PROGRAM
S. Zamir Aug. 1968 14 p
(RISO-M-780; R-24-68) Avail: CFSTI

The PDP 8 magnetic drum test program described tests the drum in a sequence selected by the user. NSA

N69-18019# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC SYNTHESIS OF DISCRETE AUTOMATA ON THE BASIS OF THE LLRSA (LOGICAL LANGUAGE FOR REPRESENTATION OF SYNTHESIS ALGORITHMS) (LYAPAS) ALGORITHM LANGUAGE
A. D. Zakrevskiy 23 Apr. 1968 29 p refs Transl. into ENGLISH from Vychislitel'nyye Sistemy (USSR), no. 18, 1965 p 5-33
(Contract F33657-68-D-0865)
(AD-679502; FTD-HT-23-10-68) Avail: CFSTI CSCL 9/2

The principal results of research and development work on the LYAPAS language (logic language for automaton-synthesis algorithms) are presented. Two levels of the LYAPAS language are created. The first level is closer to the present-day computer languages. At this level, designed to represent the detailed structure of the algorithms, programs with a volume equivalent to 200-300 machine instructions can readily be directly compiled. At the second level programs with a complex hierarchic structure are represented. A detailed description of the first level of LYAPAS is given. The methods of compiling programs in the LYAPAS language are described. The chief differences between LYAPAS and programming languages of the FORTRAN and ALGOL-60 types are pointed out. Ways of automating the synthesis and prospects for further developing the LYAPAS language are discussed. Author (TAB)

N69-18067*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPUTER RESEARCH AT MSFC
In its Res. Achievements Rev., Vol. 2 1968 10 p (See N69-18059 07-34)
Avail: CFSTI CSCL 09B

The time sharing ability and operational aspects are discussed for the Univac 1108 computer. Examples of languages solving typical problems are depicted. A brief discussion is presented on information retrieval systems and onboard computer techniques. B.P.

N69-18079*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATADIGIT SYSTEM
R. J. Stettel and J. W. Fennel, Jr. Dec. 1968 28 p
(NASA-TM-X-63436; X-721-68-483) Avail: CFSTI CSCL 09F

The DataDigit System is a part of a pulse-position-modulation (PPM) telemetry system, used extensively for sounding rocket flights. Time information, once-per-second, is printed in three Arabic numerals on analog paper records. Time source can be either a PPM countdown clock or a NASA 36-bit time code. Grid lines are provided to indicate the beginning of each second. Time written in this manner is much easier to read than the usual 100 pulse-per-second 36-bit code. Author

N69-18122# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
THE CDC 3100 COMPUTER AS A REMOTE INPUT/OUTPUT TERMINAL FOR UNIVAC 1108 COMPUTER SYSTEM
Dwight C. Seamons and Dick H. Gipson Sep. 1968 109 p refs
(Contract AT(10-1)-205)
(IDO-17259) Avail: CFSTI

A set of CDC 3100 computer programs used to transmit Univac 1108 batch jobs from a CDC 3100 to a Univac 1108 computer running under the EXEC 2 operating system was described. The 3100 is used as a remote input/output terminal linked to the 1108 via a voice grade telephone circuit. The programs are written so that the 3100 appears to the EXEC 2 operating system as a Univac 1004 remote terminal. The 1108 batch jobs are read into the 3100 by the card reader, conditioned for transmission, and sent over a half duplex voice grade telephone circuit to the 1108 system. There they are received, spooled into the job input stack, processed, and the output for each job is sent back to the 3100 where it is listed and cards punched. The report describes character conversions, compression of card images, decompression of print-punch images, formatting, and message switching techniques used by the 3100 programs. Author (NSA)

N69-18152# Centre National d'Etudes Spatiales, Brétigny-sur-Orge (France). Div. Mathematiques et Traitement.
AUTOMATIC TELEMETRY DATA PROCESSING EQUIPMENT [CHAINE DE TRAITEMENT AUTOMATIQUE DE TELEMESURES]
J. Laborde Dec. 1967 25 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.-2 Apr. 1968
Avail: CFSTI

The telemetry data processing equipment at Bretigny based on an IBM 1800 computer linked to an IBM 360/60 computer is described. The capabilities and performance of the system are evaluated. ESRO

N69-18219# Aktiebolaget Atomenergi, Stockholm (Sweden).
COMPUTATION OF RESONANCE-SCREENED CROSS SECTION BY THE DORIX-SPENG SYSTEM
H. Haeggblom Sep. 1968 34 p refs
(AE-334) Avail: CFSTI

A scheme for computation of group cross sections for fast reactors in energy regions where the resonance structure of the cross sections may be dense is described. A combination of the programs Dorix and Speng is then used. Dorix calculates group cross sections for each resonance absorber separately. The interaction between resolved resonances in the same isotope is treated using a method described in a separate report. The interaction between correlated and non-correlated resonances in the unresolved region is also considered. By a Dorix calculation we obtain effective microscopic cross sections which are then read in on a library tape. This library contains both point-by-point data and group cross sections and is used in the Speng program for computation of spectrum and/or macroscopic cross sections. The resonance interaction between different isotopes is computed in Speng by the same method as was used in the Dorix program for non-correlated unresolved resonances. Consideration is also given to the width of the resonances compared to the energy loss by a neutron colliding with some of the scattering elements. Author (ESRO)

N69-18278 Oklahoma State Univ., Stillwater.
CONTOUR PLOTTING OF RESPONSE SURFACES
Edgar Louis Butler (Ph.D. Thesis) 1967 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-8372

Nonlinear precise-data-fit techniques for contour estimation of response surfaces are examined. These techniques fit linear surfaces to responses at three observed response points and join

these surfaces to form a nonlinear surface over the data area. A study was made of the errors incurred in such a contour estimation technique. A new nonlinear precise-data-fit method was developed for contour estimation. A computer program was written to carry out the theory behind this method. An error analysis was made for the estimation procedure developed in this study. In order that the error terms have appropriate statistical distributions, it was found that the response surface had to be restricted as mentioned above. With these restrictions, it was possible to set confidence intervals on the response at any point on an estimated contour. Dissert. Abstr.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-17238# Institut Franco-Allemand de Recherches, St. Louis (France).
DETERMINATION OF THE RESPONSE OF A HIGH-PASS FILTER ON A SIMULTANEOUSLY OCCURRING FREQUENCY AND AMPLITUDE JUMP [BESTIMMUNG DER ANTWORT EINES HOCHPASSES AUF EINEN SIMULTAN AUFFRETENDEN FREQUENZ- UND AMPLITUDENSPRUNG]
V. Fleck 19 Jul. 1967 22 p In GERMAN
(ISL-N-19/67) Avail: CFSTI

Resonant responses of high pass filters to simultaneous frequency and amplitude shifts are computed by analyzing impulse initiation through the following steps: (1) development of filter transfer function in Laplace regime; (2) convolution of the initial signal with transfer function in Laplace regime; and (3) back transformation into time regime. All calculations were performed on IBM computer in FORTRAN 4 language. Transl. by G.G.

N69-17327# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE DYNAMIC RESPONSE OF A LOGARITHMIC AMPLIFIER AND A LOGARITHMIC COUNTING RATEMETER
V. H. Allen Nov. 1968 38 p refs
(AECL-3181) Avail: Atomic Energy of Canada, Ltd., Chalk River: HC $1.00

The logarithmic amplifier is used with ionization chambers and includes a log-rate circuit. The counting ratemeter is used with pulse counters and also includes a log-rate circuit. Calculations are made of the responses to inputs increasing exponentially and results are given for two particular instruments. Calculations are also made of the output noise of the counting ratemeter due to the random nature of the input pulses. The computer programs used are listed and the constants of the circuits that determine the dynamic response may be readily changed to obtain results for different instruments. Author

N69-17328# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
HIGH-DENSITY PACKAGING OF ELECTRONIC CIRCUIT MODULES
E. Miller Nov. 1968 49 p
(FSR-AD8-09-68.1) Avail: Issuing Activity

The feasibility of several packaging concepts for discrete electronic circuit components in high-density, three-dimensional stacked arrays was explored. The use of cordwood precasts and stacked integrated circuit flat-packs to package circuits of the A6A range calibrator, the OAO startracker power supply and battery charge sequence controller, and the F-111 divider module (GSE) has considerably reduced both the size and weight of these units and increased their reliability. Author

N69-17360# Illinois Univ., Urbana. Coordinated Science Lab.
AN APPLICATION OF COMPUTER OPTIMIZATION TECHNIQUES TO NETWORK SYNTHESIS
T. J. Aprille, Jr. Oct. 1968 97 p refs
(Contract DAAB07-67-C-0199)
(AD-679876; R-395) Avail: CFSTI CSCL 9/5

The report demonstrates an application of optimization methods to the area of circuit theory with the aid of the computer. Some of the important optimization techniques are outlined with the intent of giving a simplified summary of the particular method where possible. Author (TAB)

N69-17368 Illinois Univ., Urbana.
SIZE EFFECTS IN THE TEMPERATURE VARIATION OF THE ELECTRICAL CONDUCTIVITY OF EPITAXIAL GOLD FILMS
John Terence Jacobs (Ph.D. Thesis) 1967 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-8119

Measurements of the resistivity of evaporated epitaxial gold films were made over the temperature range 4.2 to 300°K. A computerized data analysis scheme, in which the operator played the part of a judgement element in the feedback loop, was used to fit the Fuchs–Sondheimer theory of size effects to the experimental data. The results for films thinner than 4000 Å are that the degree of specularity, p, varied between 0.5 and 0.95, while the static lattice imperfection resistance, ρ_i, varied between 5.2 and 9.0×10^{-8} ohm-cm. An anomalously high film resistivity in the temperature range 15 to 60°K was observed. It was attributed to small angle electron-phonon scattering. Data for films thicker than 4000 Å could not be fit exactly to the Fuchs–Sondheimer theory below 15°K and above 77°K by a single set of the parameters p and ρ_i. The cause of this mismatch is unknown. Measurements on an 8.56 micron thick gold film indicate that the lattice resistivity between 8 and 20°K varied as $T^{4.4}$. Dissert. Abstr.

N69-17453# System Development Corp., Santa Monica, Calif.
ON CUMULATIVE DAMAGE AND RELIABILITY OF COMPONENTS
V. K. Murthy and B. Lientz Wright-Patterson AFB, Ohio ARL Oct. 1968 35 p refs
(Contract F33615-67-C-1865)
(AD-680008; ARL-68-0180; SDC-SP-3199) Avail: CFSTI CSCL 14/4

Let T, X(t), and C denote the time to failure, the accumulated damage by time t, and the critical damage. Let F be the distribution function of T. Let E stand for the event of the component undergoing damage and (t sub n) denote the sequence of intervals of time between successive occurrences of E. Let T sub n = summation over n of t sub i and Y sub i denote the amount of damage experienced at time T sub n. Assume (t sub n, Y sub n) is a sequence of independent, identically distributed variables with distribution function H(t,y), so that (t sub n) and (Y sub n) are renewal processes. The inequality $F(t) < or = H(t,infinity)$ is obtained with equality if and only if C = 0. For E a Poisson process, sufficient conditions are given for F to be IHR and DMR. The classes of distribution functions are considered with the topology of complete convergence. Empirical estimates for F from observing occurrences of E are given. Author (TAB)

N69-17708# Naval Research Lab., Washington, D. C.
THE WAVEGUIDE TUNNEL DIODE AMPLIFIER: DESIGN CONSIDERATIONS

J. J. Ayoub, Jr. 12 Nov. 1968 21 p refs
(AD-679904; NRL-6764) Avail: CFSTI CSCL 9/5

An analytic design procedure for waveguide tunnel diode amplifiers based on the use of commercially available packaged tunnel diodes and the manufacturer furnished specifications for these devices is outlined. This approach is found to be inadequate for the realization of an amplifier that must meet specified performance criteria. However, the waveguide structure resulting from this design procedure should be suitable for performing microwave frequency measurements that will allow a more complete characterization of the waveguide tunnel diode network and therefore a more exact design procedure. The extreme fragility of high resistive cutoff frequency tunnel diodes requires that extreme care be used in the mounting and biasing of these devices. Pressure- and shock-absorbing devices should be used in the mounting structure to avoid destruction of the tunnel diode. It is concluded that the realization of tunnal diode amplifiers for frequencies above 26 GHz will necessitate new packaging techniques and possibly even new fabrication techniques for the tunnel diode itself.
Author (TAB)

N69-17719# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEMICONDUCTOR PROCESSING APPLIED TO INTEGRATED CIRCUIT FABRICATION
Ronald A. Cohen Aug. 1968 26 p refs
(Contract AF 19(628)-5167)
(AD-679560; TN-1968-5167) Avail: CFSTI CSCL 9/5

The note describes the processing steps and technical considerations involved in fabricating bipolar integrated circuits. Basic processes and examples of the use of these to fabricate semiconductor devices are illustrated. A bibliography of basic references to the technology and a short list of current, useful textbooks on the present state of the art are also included.
Author (TAB)

N69-17746*# Trans-Sonic, Inc., Burlington, Mass.
PRECISION dc AMPLIFIER Final Report
Jun. 1968 42 p
(Contract NAS8-5439)
(NASA-CR-98267) Avail: CFSTI CSCL 09A

This final report describes the development of a Precision D. C. Amplifier, using the parametric amplification techniques, and fabrication and delivery of prototype models. Phase I of this contract relative to the 12 Channel Digital Reporting System is complete and the final report has already been submitted.
Author

N69-17835# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REGENERATIVE SEMICONDUCTOR PARAMETRIC AMPLIFIERS (CERTAIN QUESTIONS OF THEORY AND CALCULATION) [REGENERATIVNYYE POLUPROBODNIKOVYYE PARAMETRICHESKIYE USILITELI (NEKOTORYYE VOPROSY TEORII I RASCHETA)]
V. N. Vasil'yev et al. 15 Dec. 1967 390 p refs Transl. into ENGLISH from Russian
(AD-679562; FTD-MT-24-114-67) Avail: CFSTI CSCL 9/5

The monograph covers the theory of regenerative semiconductor parametric amplifiers developed on the basis of the theory of linear circuits. Processes occurring in the parametric amplifier, represented in the form of a variable capacitor with a linear circuit connected to it, are analyzed. Expressions are derived for gain, internal noise temperature, bandwidth (with and without band-expanding filters), and optimum relationships between parameters of amplifier for which bandwidth is maximum and noise temperature is minimum are found. Different methods of tuning such amplifiers are examined. Also treated are instability of phase and frequency characteristics of the parametric amplifier, operational features of multifrequency amplifiers, and questions of electrodynamic analysis and selection of parameters of such amplifiers.
Author (TAB)

N69-17852*# Texas Instruments, Inc., Dallas.
STUDY OF SOLID-STATE INTEGRATED MICROWAVE CIRCUITS
1 Dec. 1967 191 p refs
(Contract NAS12-75)
(NASA-CR-73887; U33-811500-33; SR-6) Avail: CFSTI CSCL 09F

This report discusses a study undertaken to develop a low noise microwave PCM/FM receiver and the ceramic circuit development and package design of a transmitter. The receiver study seeks to determine a system that best meets a low noise high information capacity requirement with integrated circuit techniques. The study first examines the fundamental considerations which must be given to developing a PCM/FM receiver, then a final receiver model is selected by performing a trade study. The final receiver configuration uses a balanced mixer as the first stage and phase-lock demodulation. The design of the thin film circuits necesary to achieve the desired receiver performance is discussed. The transfer of the transmitter VCO/Modulator circuit and the power amplifier matching network to ceramic substrates is reported, the performance of the VCO ceramic circuit is given, and the final ceramic design is illustrated. A computer printout of the program used to realize the values of the matching network is included.
Author

N69-17860 Cornell Univ., Ithaca, N. Y.
A GUNN DIODE OPERATED IN THE HYBRID MODE
Ho-Chung Huang (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-9885

A new mode of operation is proposed which uses the negative differential mobility associated with the Gunn effect. This mode, called the Hybrid mode, is characterized by having the domain formation time T_D of the same order of magnitude as the active portion of the r-f period, and by a product of doping density and sample length (n_0L) between 10^{12}cm^{-2} and 10^{13} cm^{-2}. The sample contains a growing dipole layer during a large fraction of each r-f cycle. If T_D is less than the active portion of the r-f period, a traveling domain may form which is subsequently annihilated during the r-f period. A model for calculating the power and efficiency of the Hybrid mode is described. Various properties of the Hybrid mode are derived and its relationship to other modes of operation are discussed. Some experimental evidence for the existence of this mode is given.
Dissert. Abstr.

N69-17887# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
HIGH-RELIABILITY SCREENING ANF FAILURE ANALYSIS OF ELECTRONIC COMPONENTS BY TELEVISION RADIOGRAPHY
John Lombardi Nov. 1968 36 p refs
(FSN-AD9-01-68.3) Avail: Issuing Activity

Major emphasis has been placed on X-ray vidicon analysis (television radiography) for failure analysis and screening of electronic components. This rapid and non-destructive technique reveals information about a component's internal structure by displaying a magnified presentation of the interior of a device on a seventeen-inch television monitor. Previous Advanced Development reports described the application of X-ray vidicon analysis to the evaluation of microelectronic devices exclusively. However, subsequent evaluation has shown that X-ray vidicon analysis is ideally suited to the evaluation of many other types of electronic components. This report describes recent application of X-ray vidicon analysis to relays, connectors, interconnections, integrated and hybrid circuits, semiconductors, and other miniature components.
Author

N69-18013# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
MICROWAVE FERRITE PROGRAM Summary Technical Report, Period Ending Jul. 31, 1968
Paul D. Baba and S. K. Banerjee 23 Aug. 1968 73 p refs Prepared for Lincoln Lab., MIT
(Contract AF 19(628)-5167; ARPA Order 498)
(AD-678955; RR-68-21; ESD-TR-68-251) Avail: CFSTI CSCL 20/3

A program is described in which the objective was the development of a series of lithium ferrites for latching microwave device applications. Two families of compositions were explored: lithium-aluminum ferrites and lithium-titanium ferrites. Microwave, hysteresis loop, and microstructural properties were investigated as functions of compositions and processing parameters. The lithium-titanium ferrites were found to have better sintering performance relative to the lithium-aluminum ferrites, and are considered promising materials for the intended microwave applications. Author (TAB)

N69-18023# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING THE INFLUENCE OF REDISTRIBUTION OF LOADS WHEN EVALUATING THE RELIABILITY OF CIRCUITS WITH PARALLEL REDUNDANCY
A. M. Margulis 25 Apr. 1968 15 p refs Transl. into ENGLISH from Avtomat. Vychisl. Tekh. (Riga), no. 12, 1966 p 161–168
(AD-679539; FTD-MT-24-104-68) Avail: CFSTI CSCL 9/5

The paper discusses the problem of evaluating probability of failure-free work for the time T of a circuit of parallel redundancy, consisting of N elements which are joined in the series-parallel or parallel-serial modes. Considered are: (a) the possibility of the output parameter of the circuit exceeding the limits of tolerance as a result of failure of m(m < N) elements; (b) the influence of redistribution of loads on the failure rate of elements. Author (TAB)

N69-18082*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRONICS RESEARCH AT MSFC
Dorrance L. Anderson, George A. Bailey, James F. Blanche, James L. Hayes, Robert L. Kurtz et al *In its* Res. Achievement Rev., Vol. 2 1968 47 p refs (See N69-18059 07-34)
Avail: CFSTI CSCL 09A

Atmospheric turbulence causes the image of a stationary optical source to fluctuate in intensity and position. Amplitude and frequency measurements of this random position fluctuation of the image were made. A number of nondestructive testing techniques were examined as potential inspection methods for multilayer printed wiring boards. Fabrication research on a magneto-optic memory is summarized. The storage element chosen was gadolinium iron garnet doped with aluminum. The design and development of a p-channel metal oxide semiconductor transistor with a channel width of 1.8 cm. in described; calculations are made on drain to source current, input capacity, and transconductance. The microminiaturization of the gas bearing gyro servoloop electronics and associated circuitry for the platform are discussed. Development work is being conducted to achieve a highly reliable and flexible telemetry system. New equipment, such as a telemetry data compressor, is discussed. Improvements in existing equipment by using integrated circuits for superior reliability are also presented to include modernization of multiplexers and pulse code modulation equipment. B.P.

N69-18074*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF ENERGETIC PARTICLES ON PHOTOMULTIPLIERS IN EARTH ORBITS UP TO 1500 km
Walter B. Fowler, Edith I. Reed, and Jacques E. Blamont (CNRS, Paris) Dec. 1968 19 p refs
(NASA-TM-X-63419; X-613-68-486) Avail: CFSTI CSCL 09A

The response of several types of photomultipliers to energetic particles is discussed in terms of observed background current. Examples are drawn primarily from photometers for observation of the earth's airglow on two Polar Orbiting Geophysical Observatories, OGO-2 and OGO-4; brief reference is made to other OGO photometers. The largest background current was observed on OGO-2 from an EMR 541E, a sapphire end-window tube with S-20 photocathode. At a maximum of the inner electron belt, cathode current exceeded 10^{-9} amperes at about 1500 km. Several components were noted in the background current, with the most prominent due to the inner radiation belt and a component with the latitude distribution characteristic of cosmic rays. Estimated instantaneous proton and electron fluxes are compared with background current in order to obtain an approximate responsivity to energetic particles. Author

N69-18084*# General Instrument Corp., Hicksville, N. Y. Microelectronics Div.
ESTABLISHMENT OF QUALITY AND RELIABILITY STANDARDS AND DEVELOPMENT OF SCREENING TECHNIQUES FOR MOS MICROELECTRONIC DEVICES Final Report
Don Drum Nov. 1968 19 p
(Contract NAS8-20767)
(NASA-CR-98264) Avail: CFSTI CSCL 09A

Failure mechanisms in MOS microcircuits are briefly discussed and summarized. Descriptions and results are presented of testing for temperature storage step stress, temperature cycling, static voltage, and gross leakage. The tests were conducted with a variety of devices, but chiefly with P channel enhancement mode single transistors MEM 511, 20-bit static shift registers MEM 3020, 14-lead flat packs, and 10-lead TO-5 packs. K.W.

N69-18092*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
DLANET: A DIGITAL COMPUTER PROGRAM FOR THE ANALYSIS OF DISTRIBUTED-LUMPED-ACTIVE-NETWORKS
L. P. Huelsman Nov. 1968 53 p refs
(Grant NGL-03-002-136)
(NASA-CR-99491) Avail: CFSTI CSCL 09E

This report describes DLANET, a digital computer program for the analysis of Distributed-Lumped-Active Networks, i.e., networks comprised of elements which are distributed, lumped, or active in nature. The program determines the sinusoidal-steady-state response of such a network over a prescribed frequency range. A subprogram is included to provide plots of the resulting magnitude and phase characteristics. A range of options are available to specify the taper of the distributed elements, select linear or logarithmic scales, produce punched card output, etc. Author

N69-18153# Centre National d'Etudes Spatiales, Brétigny-sur-Orge (France). Div. Fusees-Sondes.
STANDARD EQUIPMENT CASING [CAISSON D'EQUIPEMENTS STANDARD]
A. Simon 23 Nov. 1967 66 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
(CNES-NT-16) Avail: CFSTI

A standard equipment casing has been designed to fit on Dauphin, Eridan and Véronique sounding rockets. It includes the support systems such as telemetry, command and control, radar reflector, sequential programmer, power supply and antennas and the connectors to the scientific payload. ESRO

N69-18165 Cornell Univ., Ithaca, N. Y.
CHARACTERIZATION OF AVALANCHE TRANSIT-TIME DIODES
Chi-Cheong Shen (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-9896

The microwave performance of an avalanche transit-time diode as an oscillator and amplifier is examined. Small- and large-signal characteristics of avalanche silicon p–n junction diode have extensively and quantitatively been investigated. The experimental system and techniques for measuring the pulse-operated avalanche diode admittance are described. Results of diode admittance and diode Q factor are presented. The nonlinearity and broad frequency range of the negative diode admittance are identified. The experimental results are in good agreement with theoretical analyses. The avalanche diode can be represented by an equivalent circuit consisting of a negative conductance in parallel with a capacitive susceptance. Both real and imaginary parts of the diode admittance are bias, frequency, and oscillatory amplitude dependent. These dependencies are described on the basis of experimental results. Dissert. Abstr.

N69-18167# Texas Instruments, Inc., Dallas.
INVESTIGATION OF RADIATION EFFECTS IN SEMICONDUCTORS
James G. Aiken, Martin G. Buehler, James S. Crabbe, and Walter T. Matzen 1 Sep. 1968 19 p refs
(Contract F19628-68-C-0184)
(AD-679634; TI-03-68-67; AFCRL-68-0520; SR-2) Avail: CFSTI CSCL 9/1

The program consists of two tasks and involves the investigation of fast-neutron radiation effects in semiconductor devices. Objectives of Task I are to determine bulk, epitaxial, and diffused-layer neutron-damage constants in silicon and to correlate them with device parameters. This report describes the pre-irradiation measurement of substrate impurity concentrations using MOS-CV and four-point probe structures fabricated on the same silicon chip. Task II objectives are the correlations of neutron degradation of h sub FE with physical device constants and damage mechanisms. The pre-irradiation characteristics of the bipolar transistor, the tetrode and the transistor with a field-plate over the emitter-base junction are presented and discussed. Author (TAB)

N69-18200*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
DESIGN AND DEVELOPMENT OF A MULTI-LAYER MEMORY SYSTEM Final Report, 28 Jan. 1966–27 Jan. 1967
F. L. Grismore, L. H. Glassman, R. P. Woodward, and M. D. Carithers 27 Jan. 1967 250 p refs
(Contract NAS8-20577; Proj. A-919)
(NASA-CR-98295) Avail: CFSTI CSCL 09A

The proposed integrated thin film memory system is feasible. A detailed system analysis showed that word drive current requirements will be approximately 150 ma and sense signals at the array terminals of 3 mv to 4 mv can be expected. Integrated circuit drivers and sense amplifiers capable of operating to these specifications were designed, fabricated, and evaluated. To eliminate demagnetizing effects and increase drive line efficiency, a ferrite keeper material was developed which provided a relative permeability of nearly 10 over a wide frequency range. This material also possesses the mechanical compliance necessary to permit it to conform to all surface variations thus providing high efficiency flux closure. The keeper is instrumental in achieving the low drive currents and high signal levels of this design. An operable memory system was not achieved; however, the majority of fabrication problems were identified and solved. Author

N69-18286# Toulouse Univ. (France). Lab. de Génie Electrique.
IRRADIATION EXPERIMENTS WITH M.O.S. TYPE TRANSISTORS (ELECTRONS OF 1 MeV, X-RAYS OF 215 keV) [EXPERIENCES D'IRRADIATION SUR LES TRANSISTORS M.O.S. (ELECTRONS DE 1 MeV, RAYONS X DE 215 Kev)]
B. Andre, D. Esteve, H. Martinot, and J. Simone [1968] 11 p In FRENCH
(LYCEN/6534/R2) Avail: CFSTI

A field effect transistor of the M.O.S. type is irradiated with electrons and X-rays and its characteristics observed, in view of space applications. ESRO

N69-18297# Harry Diamond Labs., Washington, D. C.
EXPERIMENTAL INVESTIGATION OF THE PERMANENT EFFECTS OF RF RADIATION IN X-BAND ON ELECTRONIC COMPONENTS
Nikolai Tschurain Jun. 1968 66 p refs
(AD-678559; HDL-TR-1399) Avail: CFSTI CSCL 9/1

An experimental investigation was conducted at X-band frequencies to determine the effects of rf radiation on composition resistors, crystal diodes, transistors, and metal oxide silicon field-effect transistors (MOSFET). To obtain maximum power transfer, the component leads were cut and bent to form a half-wave dipole tuned to the excitation frequency. The component was placed in a microwave assembly, oriented parallel to the electric field, and exposed for several minutes until thermal equilibrium was established. Data concerning permanent changes in the electrical characteristics of the components as a function of exposure to the E-field were obtained. Measurements were taken of the temperature rise of the components while various types of convection and forced-air cooling were employed. These measurements indicate that the changes in the electrical characteristics of the components are primarily a function only of the temperature rise produced in the component and only secondarily if at all, a function of the field intensity per se. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-17390 Florida Univ., Gainesville.
OPTIMAL CONTROL COMPUTATIONAL TECHNIQUES FOR DISTRIBUTED PARAMETER SYSTEMS
Syama Prasad Chaudhuri (Ph.D. Thesis) 1967 219 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-9460

This work discusses the mathematical description of distributed parameter systems, the formulation of optimal control problems, the derivation of a Maximum Principle for a particular class of systems, and the problems associated with approximating distributed systems by discretization into lumped systems. Examples concerning the optimal control of nonlinear and linear distributed regulator problems with a quadratic cost function for a diffusion process are presented. Solution is obtained for the open-loop distributed control and a closed-loop distributed control. The distributed system is lumped by three approximation schemes and the corresponding controls obtained for the three lumped models. Comparison of computational effort and accuracy of solutions for the various methods is presented. The method of gradients and quasilinearization have been applied, perhaps for the first time, to a class of

nonlinear distributed parameter systems. Solution is obtained for the open-loop distributed control for a variety of initial spatial distributions. Dissert. Abstr.

N69-17621# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MODULAR CONSTRUCTION PRINCIPLE OF CONTINUOUS ACTION INDUSTRIAL REGULATORS
A. I. Birman et al 19 Apr. 1968 23 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Inst. Avtomatiki i Telemekaniki Pnevmoavtomatika (Moscow), 1966 p 71–80
(AD-679804; FTD-MT-24-86-68) Avail: CFSTI CSCL 13/7

Various standard pneumatic control modules, circuits and subsystems are described. TAB

N69-17703# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Electrical Engineering.
SIGNAL ANALYSIS METHODS FOR ADAPTIVE CONTROL SYSTEMS Terminal Scientific Report
Preston R. Clement and Robert Staffin 1 Nov. 1968 207 p refs
(Grant AF-AFOSR-601-66)
(AD-679611; SIT-36-067; AFOSR-68-2804) Avail: CFSTI CSCL 12/1

The report describes research on adaptive control systems from an analytical point of view. Specific topics discussed include the Laguerre functions as a quasi-optimal basis set, identification of finite-memory systems through the use of functions orthogonal on a finite interval and time-adjusted gain-an approach to adaptive control. TAB

N69-17868 Arkansas Univ., Fayetteville.
SYNTHESIS AND DESIGN OF QUANTIZED CONTROL SYSTEMS
Bobby Eugene Gilliland (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-9635

A hybrid control system consists of continuous-time components, discrete-time components, and buffer or interface components. A digital controller used with a continuous plant is an example of a hybrid system. All digital control systems contain at least one signal which is sampled in time and quantized in amplitude. Problems exist in establishing design procedures leading to the construction of quantizers with satisfactory performance characteristics. Several methods of analyzing quantized control systems resulted from this investigation. Methods for specifying quantizer design characteristics were developed. These methods are based on state variable techniques and generally require implementation of a digital computer for second-order systems or above. These methods, however, are not restricted by plant order, input characteristics, initial condition constraints or complexity of the quantizer. Dissert. Abstr.

N69-17869 California Univ., Berkeley.
ON CONTROL OF FLEXIBLE STRUCTURES
Hans-Fredrik Milliers (Ph.D. Thesis) 1967 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-10373

Solutions are given to the problem of the control of flexible structures. The flexible structures considered are both lumped mass-spring systems and distributed flexible structures such as flexible beams or a combination of both. In particular, the synthesis problem is discussed when the feedback law is restricted to have constant feedback gains and the closed loop system to have a bandwidth about the fundamental frequency of the flexible structure. Three new design methods are suggested. The first method utilizes the orthogonality and node properties of the eigenfunctions of flexible beams to simplify the design of the control system. Certain modes are made unobservable. The second method consists of synthesizing specified closed loop poles. A new algorithm is derived. The third approach is the most general and is not limited to flexible structures. The design method can be applied to all linear systems and a large class nonlinear systems. Dissert. Abstr.

N69-17953 Washington Univ., St. Louis, Mo.
LOSS-INDUCED SLOW MODE BEHAVIOR IN A COAXIAL STRUCTURE
Pong Fui Chang (Ph.D. Thesis) 1968 184 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-10791

A theoretical analysis of the propagation behavior of a coaxial transmission line with two concentric loading media is performed. The analysis is restricted to the lowest order E-Mode, which is the dominant mode. The longitudinal-transverse separation of Maxwell's equations in generalized coordinate systems are derived. One special case (cylindrical coordinates, ρ-direction as the direction of propagation) yields the Bessel function transmission line equations, which are used to give the transverse resonance equation for solving the eigenvalue problem. The lossless behavior of the line is discussed in two cases: the surface wave mode and the waveguide mode. The dispersion relationships are derived. Numerical analysis of the complex compound Bessel function $sn(z_1-z_2)$, $Cs(z_1-z_2)$ and $tn(z_1-z_2)$ are combined with the Newton–Raphson method to solve the transmission line problem with lossy layers by numerical methods. A Fortran program description is included. Dissert. Abstr.

N69-18240#
MULTICHANNEL COMMUTATOR WITH LOW INTRINSIC NOISE LEVEL
V. I. Igritskii et al [1968] 6 p refs Transl. into ENGLISH from Pribory i Sistemy Upravleniia (USSR), no. 11, 1968 p 41–43
Avail: CFSTI

A magnetically controlled lobe shaped relay (MULR) was developed to be used as a key in a commutator system. The MULR consists of contacts made from a special magnetic alloy and coated with silver to diminish the bridging resistance and the contact potential difference. The rate of operation is determined by the difference between the actual ampere-turns produced by the control coil, and the force capable of overcoming the elasticity of the contacts. The MULR has a low forward contact bridging resistance, a great back resistance, and possesses relatively good fast response. A commutator circuit was developed from the MULR for commutation of low level signals of both polarities. The error in transmission of these signals is negligible. S.P.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges, and tracking stations.

N69-17239# Institut Franco-Allemand de Recherches, St. Louis (France).
CENTRIFUGE FOR EXPERIMENTATION [ZENTRIFUGAL-SCHLEUDER FUER PRUEFZWECKE]
D. Bock and H. Masur 26 Sep. 1967 11 p In GERMAN
(ISL-N-17/67) Avail: CFSTI

Design and performance of a test centrifuge for acceleration tolerant measuring devices are discussed. The apparatus is used to evaluate signal calibration of signal transmitters and generators for rocket technology. Transl. by G.G.

N69-17247 University of Southern Calif., Los Angeles.
BLAST WAVE GENERATION BY ELECTRICAL DISCHARGE WITH EXPERIMENTS ON TRANSMISSION THROUGH STRUCTURES
Frederick Bigelow Safford (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-10250

An investigation was undertaken to develop a laboratory apparatus for the generation of blast waves by high voltage electrical discharge. Secondary objectives were the use of this apparatus in experiments on blast wave transmission through structures to secure information not previously available and to demonstrate the machine as a research tool. A series of experiments on transmission of the blast wave through flat aluminum plates and through porous panels were conducted at various angles of incidence. Data evaluation was made in terms of transmission loss and spectra comparison of the Fourier transforms of the input and output waves. Dissert. Abstr.

N69-17502# Illinois Univ., Urbana. Aeronomy Lab.
PLAN FOR THE IMPLEMENTATION OF A THOMPSON SCATTER RADAR
J. V. Evans and S. A. Bowhill 15 Jan. 1968 83 p refs *Its* Aeronomy Rept. No. 24
(Grant NSF GA-1046)
Avail: Issuing Activity

A design for a three-station Thomson scatter radar facility for studies of the earth's upper atmosphere has been developed. This document presents a plan for performing the detailed engineering design, the construction and the operation of the facility. The design and construction phases are expected to require six to seven years and cost approximately $23 million. Author

N69-17541# Illinois Univ., Urbana. Dept. of Physics.
A STUDY OF THE HIGH ENERGY PHYSICS GROUP COMPUTER NEEDS
R. M. Brown, R. D. Sard, and G. T. Scharf Oct. 1968 22 p
(Contract AT(11-1)-1195)
(TR-174; COO-1195-147) Avail: CFSTI

An analysis is made of the research operations and costs of the High Energy Physics Group with particular emphasis on the projected computer requirements arising from the DOLLY bubble chamber film measuring system and the Sigma 2 spark chamber data acquisition computer. The current costs per computer hour and per analyzed event are seen as strongly limiting factors in the future research plans. Acquisition of a computer system to process DOLLY output on-line and event analysis off-line is proposed. Author (NSA)

N69-17747*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE 10-ft SPACE SIMULATOR AT THE JET PROPULSION LABORATORY
W. Alexander, L. Dyckman, J. Harrell, W. Nelson, and W. Schaefle 15 Jan. 1969 25 p ref Revised
(Contract NAS7-100)
(NASA-CR-73890; JPL-TR-32-1231-Rev-1) Avail: CFSTI CSCL 14B

This report describes the JPL 10-ft space simulator facility that is used for JPL, NASA, and NASA-authorized testing purposes. The report also provides sufficient technical information for proper planning of simulator tests. Author

N69-17858# California Univ., Berkeley. Lawrence Radiation Lab.
OPTICS OF THE AXIAL INJECTION LINE FOR THE 88-INCH CYCLOTRON
F. Resmini Sep. 1968 22 p refs
(Contract W-7405-ENG-48)
(UCRL-18442) Avail: CFSTI

A new axial injection beam transport line has been designed for the 88-inch cyclotron. The line uses polarized ion and duoplasmatron ion sources, electrostatic quadrupole triplet lenses with a 7.3-cm aperture, sets of collimators within every triplet, deflection plates, bunches, and three sets of monitoring equipment. The beam optics including matching requirements, and transmission efficiencies, of the line are discussed. NSA

N69-17923# Institut Franco-Allemand de Recherches, St. Louis (France).
CONTRIBUTION TO THE RESEARCH ON TERNARY DETONATION WAVE GENERATORS (CYLINDRICAL OR SPHERICAL PROFILES) [CONTRIBUTION A L'ETUDE DES GENERATEURS TERNAIRES D'ONDE DE DETONATION]
J. P. Decamps 2 Aug. 1967 21 p ref In FRENCH
(ISL-T-29/67) Avail: CFSTI

The development of a detonation wave generator is discussed. The generator is composed of alternating explosive and inert concentric tubes fastened at one end to a bursting charge. The geometric arrangement of the generator allows the formation of a spherical wave by the ring formation of the individual detonation fronts. The wave profile angle with the generator axis is of importance and predetermined. The relationship n between detonation velocity of the initial explosive charge cap and the explosive material that forms the concentric tubes is determined by $(n > 1)$. Transl. by G.G.

N69-17942*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN AND CONSTRUCTION OF THE 15-ft-BEAM SOLAR SIMULATOR SS15B
R. P. Eddy 1 Oct. 1968 75 p refs
(Contract NAS7-100)
(NASA-CR-73891; JPL-TR-32-1274) Avail: CFSTI CSCL 14B

The modification of the 25-ft space simulator to incorporate a larger, higher quality solar simulator produced an initial 15-ft-diam beam of better than ±5% uniformity measured throughout the test volume. Although similar in general arrangement to the system developed for the 10-ft simulator, it employs several improvements. The uniformity and collimation are improved by defocusing and rotating the collimator and by using the aberration effect of the condensing lenses in the mixer lens assembly. The efficiency has been improved by incorporating a lens in the vacuum interface window. The use of water-cooled, 20-kW xenon arc lamps allows the system to be operated with a fewer number of lamps and related support equipment. Every effort was made toward combining potential and flexibility into the design by utilizing the latest advances in solar simulation technology. The conservative design of the simulator makes available sufficient reserve power which can be used for enlarging the beam to the ultimate 20-ft diam, providing up to planet Mercury irradiance, reducing the collimation angle, or improving the spectrum by selective filtering. Author

N69-17947*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Technical Report, 1 Sep.-31 Oct. 1968
30 Nov. 1968 110 p *Its* Space Programs Summary 37-54, vol-2
(Contract NAS7-100)
(NASA-CR-73955) Avail: CFSTI CSCL 22D

Brief descriptions of the Deep Space Network (DSN) and the DSM simulation system are followed by results of work performed by the DSN team as follows: (1) mission support of

Mariner Mars 1971 and Mariner 5 extended operations; (2) advanced engineering in tracking and navigational accuracy, phase jitter of programmed oscillators, a computer interrupter, tracking and data acquisition elements, and supporting research; (3) network development and operations in telemetry systems, equipment, and testing; (4) development and operations of the Deep Space Instrumentation Facility (DSIF) in time synchronization, data processing, telescopes, klystrons, amplifiers, maintenance, and quality control; and (5) developments at the Cebreros DSS antenna reflector and the Pioneer DSS antenna. K.W.

N69-18130# European Organization for Nuclear Research, Geneva (Switzerland).
ECFA: EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS. UTILIZATION STUDIES FOR A 300 GeV PROTON SYNCHROTRON, VOLUME 3
P. Schiavon, ed. 30 May 1967 167 p refs
(CERN/ECFA-67/16-VOL-3; CERN/ECFA-66/WG2/US-SG2/TR3; INFN/AE-66/7) Avail: CFSTI

Computer calculations of the kinematics for pp, Kp, and πp interactions and π, K, Λ, Σ, and ξ decays are presented. The data are compiled for future use with the 300-GeV proton synchrotron. NSA

N69-18141# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information.
GeV (1000) CYBERNETIC PROTON ACCELERATOR
A. A. Vasil'ev, ed. Oct. 1968 349 p refs Transl. into ENGLISH of the book "Kiberneticheskii Uskoritel' Protonov na Energiyu 1000 GeV" Moscow, Izd. AN SSSR, 1967
Avail: CFSTI

The systems and results of the preliminary design of the basic (large), 1,000-FeV annular proton accelerator, intermediate annular 196-GeV accelerator (booster), and linear 800-MeV accelerator-injector are described. The study, which established the feasibility of the 1,000-GeV cybernetic proton accelerator on the basis of the existing elements and tested designs of elements, was prepared by a team of specialists of the Radio-Engineering Institute of the AS USSR. The work started in 1960. In order to increase the mean intensity up to $\approx 10^{13}$ protons per second, the particles are accumulated in a large ring serviced by a linear accelerator and a booster, both working at a repetition frequency of about 20 Hz. Specially designed automatic control devices will prevent the shifts of orbits outside the region of the magnetic field. Digital computers will be used for the overall control and adjustment during various possible operating conditions. NSA

N69-18238# Joint Publications Research Service, Washington, D.C.
SIX BILLION ELECTRON-VOLT ELECTRON ACCELERATOR
A. I. Alikhan'yan 27 Jan. 1969 30 p Transl. into ENGLISH from Priroda (Moscow), no. 11, Nov. 1968 p 1–16
(JPRS-47316) Avail: CFSTI

A general review is presented of the operation and parameters of the six billion electron volt electron accelerator at Yerevan, U.S.S.R. Light electromagnetic oscillations, heavy light oscillations, and Cerenkov radiation are briefly discussed, along with high energy physics research carried out by the instrument. B.P.

N69-18286# Centre National d'Etudes Spatiales, Brétigny-sur-Orge (France). Div. Mathé Matiques et Traitement.
TELEMETRY DATA PROCESSING EQUIPMENT AT CNES [EQUIPEMENT DU CENTRE DE TRAITEMENT DES TELEMESURES DU CNES]
J. M. Frichet and G. Raphanel 10 May 1967 40 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

The telemetry data processing equipment at Bretigny is described. The characteristics and performance of the tape recorders, decoding systems, visual displays and converters included in the system are given. ESRO

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-17240# Institut Franco-Allemand de Recherches, St. Louis (France).
EVALUATION OF DIFFERENTIAL INTERFEROMETER DETECTIONS OF ROTATIONAL SYMMETRY IN THE AREA OF GAS DYNAMICS [AUSWERTUNG VON DIFFERENTIAL-INTERFEROMETER-AUFNAHMEN ROTATIONSSYMMETRISCHER GASDYNAMISCHER PROZESSE]
M. Hugenschmidt and K. Voitrath 31 Oct. 1967 20 p refs In GERMAN
(ISL-T-14/67) Avail: CFSTI

An evaluation method for differential interferometric spectra of symmetrical rotation is described and used to obtain the refractivity index of a flow field from measured band displacements. Example calculations develop the refractive index profile of a laser triggered spark discharge in air 10 μs after release. The density increase in the shock front is also calculated. Transl. by G.G.

N69-17241# Institut Franco-Allemand de Recherches, St. Louis (France).
OPTICAL STUDY OF WAKES OF HYPERSONIC PROJECTILES IN A LOW PRESSURE ATMOSPHERE [ETUDE OPTIQUE DE SILLAGES DE PROJECTILES HYPERSONIQUES EN ATMOSPHERE A BASSE PRESSION]
H. Royer, P. Smigielski, M. Devaud, and A. Stimpfling 11 Apr. 1967 19 p refs In FRENCH
(ISL-T-11/67) Avail: CFSTI

Various optical methods for observing the wake behind hypersonic projectiles are described. Shadow photographs were obtained at pressure up to 100 Torr, interference photographs up to 90 Torr pressure, and Schlieren photographs up to 50 Torr. Only Schlieren photography was found suitable for wake visualization at low pressures. Transl. by G.G.

N69-17262 Oklahoma Univ., Norman.
EVALUATION OF THE APPLICABILITY OF AN EXPLICIT NUMERICAL METHOD TO A PLANE, TURBULENT, LOW VELOCITY, PARTIALLY CONFINED JET
Song-yeong Ruo (Ph.D. Thesis) 1967 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-8490

A study was conducted to examine the applicability of an explicit, Eulerian, numerical technique to approximate the flow characteristics of a two-dimensional, low velocity, turbulent jet issuing from a nozzle over a cavity. This configuration involves flow similar to that of a proportional fluid amplifier. From the basic hydrodynamic equations, a set of governing equations for the turbulent flow case was derived to describe the flow. Artificial dissipative terms were added to each of the governing equations to stabilize the numerical integration. The effects of using various finite difference methods to represent the space derivatives, various methods to estimate the fluid properties on the boundaries, and the assumptions of incompressible or compressible flow were explored. Methods of non-dimensionalizing the governing equations were also studied. In addition to the explicit methods considered, an implicit method was also investigated. Dissert. Abstr.

N69-17264 Pennsylvania State Univ., University Park.
AN EXPERIMENTAL INVESTIGATION OF THE SMALL-SCALE STRUCTURE OF TURBULENCE IN A CURVED MIXING LAYER
John Corry Wyngaard (Ph.D. Thesis) 1967 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-8761

The small scale structure of turbulence in a curved mixing layer was experimentally investigated. Extremely small (.000025 in. diameter, .006 in. long) hot wire sensors, a wide band linearized constant temperature hot wire anemometer, and a sharp cutoff differentiator were developed in order to carry out the study. The measurements showed that no significant differences existed in the small scale structure of the turbulence in the stable and unstable cases. The turbulent energy budgets were similar, in contradiction to the earlier results; this discrepancy was attributed to instrumentation errors in the earlier work. One dimensional spectra agreed well in the two cases and with spectra found in other turbulent flows. Probability densities of the velocity derivatives were identical in the two cases. The probability distributions of the first two streamwise derivatives of the streamwise fluctuation were closely log-normal, which gave support to models of the fine structure of turbulence which make this prediction. Dissert. Abstr.

N69-17269 Rochester Univ., N.Y.
STABILITY OF PIPE POISEUILLE FLOW
Stanley Gene Sadler (Ph.D. Thesis) 1968 183 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-9393

The stability of pipe Poiseuille flow to small, three-dimensional disturbances, the effects of flexible tube parameters, Reynolds number, and azimuthal and axial wave number of the disturbance on the stability of the flow are established. The Navier–Stokes equations and continuity equations are linearized by neglecting products of disturbance velocities in the acceleration terms, and are nondimensionalized. By assuming an exponential angular, axial, and time dependence for disturbance pressure and velocities four linear, coupled, ordinary differential equations result. The pressure and three disturbance velocities are required to be continuous and bounded at the tube center, and the fluid and tube wall velocities are required to be the same at the fluid–tube interface. Thin shell equations of motion for the tube are combined with the boundary conditions to give a determinental equation, which is satisfied by an eigenvalue combination of fluid and tube parameters. Dissert. Abstr.

N69-17294 Institut Franco-Allemand de Recherches, St. Louis (France).
NUMERICAL STUDIES ON FLOW OF DETONATING GAS AROUND A CONE [NUMERISCHE UNTERSUCHUNGEN ZUR DETONATIVEN KEGELSTROEMUNG]
F. Wecken, H. Behrens, and B. Adam 22 Sep. 1967 37 p refs In GERMAN
(ISL-5/67) Avail: CFSTI

Variational methods are used to analyze the rotational symmetrical flow of a detonable ideal gas around a supersonic circular cone. The four main parameters of adiabatic exponent, Mach number, angle of impact, and temperature are approximated and the validity of the approximation formula in boundary value problems is discussed. This approximation method is applied to the ballistic evaluation of high speed shots in explosive gas mixtures with shock induced combustion. Transl. by G.G.

N69-17301# Institut Franco-Allemand de Recherches, St. Louis (France).
CALCULATION OF HYPERSONIC FLOW IN THE SHOCK LAYER IN FRONT OF A BLUNT BODY, MASLEN METHOD. REAL GAS EQUILIBRIUM. BODIES OF REVOLUTION WITHOUT INCIDENCE [CALCUL DE L'ECOULEMENT HYPERSONIQUE DANS LA COUCHE DE CHOC A L'AVANT D'UN CORPS EMOUSSE, METHODE DE MASLEN. GAZ REEL A L'EQUILIBRE. CORPS DE REVOLUTION SANS INCIDENCE]
G. Lacau 21 Dec. 1967 22 p refs In FRENCH
(ISL-T-45/67) Avail: CFSTI

Described is a simple approximation method for calculating the hypersonic flow behind a shock layer of known dimensions. This method makes it possible to determine the flow lines (shape and distribution of thermodynamic parameters) for a corresponding body shape. Transl. by G.G.

N69-17339 Rochester Univ., N. Y.
ON THE HYDRODYNAMIC STABILITY OF THE REENTRY FLOW FIELD
Shu-Yi Wang (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-9402

The hydrodynamic stability of the reentry flow field for a compressible fluid is investigated theoretically with respect to infinitesimal disturbances of the Taylor–Gortler type. The characteristic equation of the disturbance equations is solved by the finite difference method. As far as the hydrodynamic stability is concerned, it is found that the influence of the free stream Mach number is relatively less important than that of the wave number of the disturbance. In the subsonic region of this flow field, in which most streamlines have positive curvature, the flow is stable at moderate values of wave number and unstable when the value of the wave number is either too high or too low; on the other hand, in the supersonic region, in which most streamlines have negative curvature, the flow is mainly unstable at large values of wave number. For a particular wave number, the flow is more stable when the free stream Mach decreases. Dissert. Abstr.

N69-17350# Aerospace Corp., San Bernardino, Calif.
A SOLUTION OF SHOCK-INDUCED BOUNDARY LAYER PROBLEMS BY AN INTEGRAL METHOD
John W. Murdock Aug. 1968 41 p refs
(Contract F04695-67-C-0158)
(AD-679625; TR-0158(S3816-63)-7; SAMSO-TR-68-435) Avail: CFSTI CSCL 20/4

An integral technique is developed to solve a general class of shock-induced boundary layer problems. Included in this class are the boundary layer which grows near the leading edge of a semi-infinite flat plate with a shock wave propagating over it and the boundary layer region in a shock tube which is dependant upon both the shock wave and the expansion wave. The assumed boundary layer profile used to solve the Howarth transformed (incompressible) momentum equation is a linear combination of two exact solutions to the boundary layer equations, with the relative proportion of these two solutions controlled by a shape factor similar to the Karman-Pohlhausen shape factor. The present shape factor differs from that of Karman and Pohlhausen in that it is controlled by the dgree of unsteadiness in the boundary layer rather than by the pressure gradient. The solutions generated by the present technique are in good agreement with published exact solutions. The incompressible values of the momentum and displacement thicknesses are within 5 percent of the exact value and the wall shear stress is within 1 percent. While this accuracy should be satisfactory for most purposes, certain refinements are possible which will reduce all errors associated with the integral technique to values on the order of 1 percent. Author (TAB)

N69-17384# Aerospace Corp., El Segundo, Calif. Lab. Operations.
INTEGRAL SOLUTION FOR BOUNDARY LAYERS WITH LARGE BLOWING Technical Report, Feb.–May 1968
William S. King Sep. 1968 17 p refs
(Contract F04701-68-C-0200)
(AD-679776; TR-0200(4240-10)-5; SAMSO-TR-68-426) Avail: CFSTI CSCL 20/4

The compressible, laminar boundary layer with surface blowing is investigated by the momentum integral technique. The unique feature of the study is that velocity and enthalpy profiles are derived from a consideration of momentum and energy equations near the wall. This procedure provides general and accurate profiles, but it biases the solution toward moderate and large blowing limits. Approximate solutions are obtained for self-similar flows, and the effects of pressure gradient and surface temperature are discussed. It is shown that the wall shear can be zero for a finite amount of blowing either when the pressure gradient is zero, which is well known, or when the wall temperature is zero, which is believed to be a new result. Detailed calculations of flow over a flat plate are presented for self-similar and uniform blowing distributions. These results compare favorably with the exact calculations.
Author (TAB)

N69-17375 Pittsburgh Univ., Pa.
AN EXPERIMENTAL INVESTIGATION OF PRESSURE GRADIENTS TO TWO-PHASE FLOW WITH GAS BUBBLES IN THE VICINITY OF THE WALL
Robert Michael Roidt (Ph.D. Thesis) 1967 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-9745

The problem considered is a determination of the influence of bubbles and in particular, bubbles near a channel surface, upon the transport characteristics of a turbulent flow. The experimental apparatus is a rectangular duct with a cross-section of 0.25 by 6.0 inches installed in a 30 gpm water flow loop. Bubbles are introduced transverse to the 6.0 inch measurement after a development length of 200 duct spacings. The duct is horizontal with the 6.0 inch measurement vertical. Two methods of bubble introduction are used: first, hydrogen bubbles are generated by hydrolysis from wires held in the flow at various distances from the walls, and second, porous plate manifolds are placed flush with the duct surface on each of the 6.0 inch walls and nitrogen is forced through these to generate bubble layers. Pressure measurements are taken over a distance of 3.0 inches starting 3.0 inches downstream from the point of bubble injection. To correlate the resulting data with those obtained by G. B. Wallis from a similar experiment with porous walled tubes of various diameters, certain aspects of flow boiling phenomena are considered.
Dissert. Abstr.

N69-17394*# IIT Research Inst., Chicago, Ill.
FUNDAMENTAL CONSIDERATIONS OF THE CROSSED-BEAM CORRELATION TECHNIQUE Final Report
M. J. Fisher and R. J. Damkevala Jan. 1969 79 p refs
(Contracts NAS8-11258; NAS8-20408)
(NASA-CR-61252) Avail: CFSTI CSCL 20D

Summarized are the conceptual details of the "crossed beam correlation technique". Two beams of radiation are employed which traverse the entire flow field in two mutally perpendicular directions. Turbulence induced fluctuations of either the thermo-dynamic properties or concentrations of the chosen property result in fluctuations in detected light intensity. Each beam alone reflects only an integral of the fluctuation occurring along its entire path. It is shown that cross correlation of the two detected signals eliminates much of the integration yielding local turbulent properties. Specifically it is shown that the local value of the intensity of the fluctuations, the integral scales of turbulence, the convection speeds, turbulent spectrum and moving axes time scales can be obtained using this method. It is also shown that the method offers a distinct advantage over probe techniques in the estimation of turbulence forcing functions, while the hitherto elusive three-dimensional spectrum function can be obtained from anisotropic flow.
Author

N69-17422 Kansas State Univ., Manhattan.
THE APPLICABILITY OF THE RENEWAL-PENETRATION MODEL TO TRANSPORT PROCESSES ASSOCIATED WITH AXIAL FLOW AND FLOW PAST SUBMERGED BODIES
Lindon Carl Thomas (Ph.D. Thesis) 1968 329 p
Avail: Univ. Microfilms: HC $14.85/Microfilm $4.25 Order No. 68-9921

The applicability of the renewal-penetration model as a tool in analyzing and characterizing various transport processes was evaluated. The basic expressions for the instantaneous transport flux were developed for small but macroscopic particles which come into contact with a transport surface. The assumptions upon which these equations are based were clearly set forth and shown to be reasonable. Subsequently, the basic form of the renewal-penetration model was developed on the basis of the delay contact time distribution. Essentially two renewal modes were proposed; the impingement renewal mode and the transverse renewal mode. The transverse renewal mode was suggested to be of two types; these are the transverse renewal mode for which both the inertial and viscous forces are significant, and the inertial dominated transverse mode. For impinging type flow, fluid is continuously driven toward the surface by the bulk velocity which acts as a driving potential. A general expression was developed for the mean residence time associated with the transverse renewal mode.
Dissert. Abstr.

N69-17423 Delaware Univ., Newark.
EQUILIBRIUM TEMPERATURES IN FLOW OF AN ABSORBING-EMITTING GAS
Yehuda Taitel (Ph.D. Thesis) 1967 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-9612

The effect of radiation on the equilibrium temperature for a flow of emitting-absorbing gas over a flat plate is studied. Three methods of solution are formulated: An approximate solution for a thin boundary layer, a similarity solution for the limiting case when the boundary layer is optically thick, and an exact solution. Emphasis is put on the study of the recovery or adiabatic wall case where conduction to the wall is balanced by the net radiation away from the wall. Results are reported for the limiting cases of a black plate and completely reflective plate and for a unit Prandtl number. The exact solution reflects very favorably on the use of the approximate methods and points out clearly the conditions for which the approximate solutions are applicable. Results are also reported for the equilibrium wall temperature for the case of constant heat flux and for the recovery factor in the case of blowing and suction, both for optically thin boundary layers.
Dissert. Abstr.

N69-17466*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DRAG ON FLAT PLATES OSCILLATING IN INCOMPRESSIBLE FLUIDS AT LOW REYNOLDS NUMBERS
Harry Buchanan 22 Jul. 1968 55 p refs
(NASA-TM-X-53759) Avail: CFSTI CSCL 20D

An investigation of the flow about two-dimensional plates oscillating in an incompressible fluid at low Reynolds numbers is presented. The case in which the fluid mass is stationary and the plate oscillates is compared to the case of a plate submerged in an oscillating stream using potential theory. A series of experiments is described in which force-time histories were recorded for a plate oscillating through a basin of fluid at rest. In addition, a series of dye streak photographs shows the characteristic fluid motion. A drag coefficient is defined and values are computed from the experimental data. This coefficient is shown to be a function of both Reynolds number and a dimensionless period parameter. At very low values of Reynolds number the coefficient increases sharply with decreasing Reynolds number. A discussion of the application of this data to the problem of slosh damping by baffles under low gravity conditions is presented.
Author

N69-17513 Pennsylvania Univ., Philadelphia.
THE THICKNESS OF A ROTATING LIQUID HELIUM FILM
Roger Edward Little (Ph.D. Thesis) 1967 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-9218

The effect of large film critical velocities on rotation was investigated by measuring the thickness of a rotating liquid helium film. A variation of Jackson's optical technique is used to measure changes in film thickness directly. The helium film being studied forms on the top of the rotor of a superconducting motor. The thickness of the film is found to be a monotonically decreasing function of both the temperature and the angular velocity. Rotation causes no change in film thickness larger than the experimental error of ± 8Å at the low temperature limit of the cryostat, 1.25°K. These results are compatible with the superfluid component remaining at rest and the normal component rotating with the moving disk. The results are discussed in terms of the possible types of vortices in the film and pinning of vortex lines. It is concluded that the null effect for the superfluid component is a consequence of the non-existence of vortex lines with their axes perpendicular to the film. Dissert. Abstr.

N69-17548# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
TEMPERATURE-TIME HISTORY OF RIGHT CIRCULAR CYLINDER IN HYPERSONIC FLOW
Ronald A. Briggs and James S. Petty Aug. 1968 17 p refs
(AD-680004; ARL-68-0149) Avail: CFSTI CSCL 20/4

A solution of the problem of unsteady heat transfer to a right circular cylinder in laminar hypersonic flow was found. The solution is based upon the assumption that the heat transfer to the surface of the cylinder is proportional to the cosine of the angle measured from the stagnation point. The solution is expected to be valid within 70 degrees of the stagnation point. Author (TAB)

N69-17585# Naval Ordnance Lab., White Oak, Md.
THE CAVITY AFTER VERTICLE WATER ENTRY
Albert May 12 Jul. 1968 48 p refs
(AD-679905; NOLTR-68-114) Avail: CFSTI CSCL 16/4

At vertical water entry of a missile the splash varies greatly with nose shape and thus modifies the cavity development. Accordingly, the relations reported earlier between cavities formed by different noses at oblique entry, cannot be applied to vertical entry. An Ideal Cavity is defined as that portion of the cavity near the generating nose, which has not been appreciably affected by such influences as gravity or the difference between ambient pressure and the pressure in the cavity. It is shown that all such cavity portions are geometrically similar, with a size proportional to the square root of the drag force at a given speed. Author (TAB)

N69-17659# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
A STUDY OF THE ION WAKE ON AN ELECTRON BEAM IN A FREEJET
Donald W. Harvey Aug. 1968 141 p refs
(Grant AF-AFOSR-697-67)
(AD-679631; USCAE-109; AFOSR-68-2342) Avail: CFSTI CSCL 20/4

A narrow beam of 10-50 KV electrons is coming into wide use as a probe of rarefied gas flows. Such a beam forms ions in many gases, including nitrogen. These ions form a stream, or wake, downstream of the beam. This work is a study of such a wake in a free jet of nitrogen, for the purpose of finding, if possible, conditions under which information about the state of the gas may be inferred from the behavior of the wake. Relations are derived between the wake flux cross-section and gas lateral and axial temperatures at the beam. Perturbations due to collisions and induced fields are considered. An ion wake is found experimentally, using as a probe a conductor at the local flow potential. The flux cross-section of the wake is shown to consist of two components, one proportional to gas density at the beam, the other approximately independent of gas density. The density-dependent component shows approximate agreement with theory. The constant component is discussed and some suggestions as to its origin are advanced. Author (TAB)

N69-17668# Rensselaer Polytechnic Inst., Troy, N. Y.
RECIRCULATORY FLOW IN A CYLINDRICAL CAVITY
William D. Ernst Sep. 1968 48 p refs
(Grant NSF GK-618)
(TR-PT-6804; PB-180276) Avail: CFSTI CSCL 13F

An investigation is made of the laminar, large Reynolds number, two-dimensional recirculatory flow induced in a circular cylinder by the steady tangential motion of a segment of the periphery. A review of the pertinent published literature indicates that the theoretical and experimental results are inconclusive, except for the observation that the flow field configuration may be idealized as a constant-vorticity core surrounded by a boundary layer along the wall. With the assumption of this flow configuration, a solution for the peripheral boundary layer is derived by utilizing for the stationary and the moving wall respectively two linearized forms of the laminar boundary layer equation, each containing an arbitrary stretching-function. The mathematical solution to the problem is approached through a Fredholm integral equation for the boundary layer velocity distribution. For the primitive case where the two stretching-functions for simplicity are assumed to be equal to the same constant, results are calculated which are in complete agreement with previous work by Mills. Author (USGRDR)

N69-17710 Pennsylvania Univ., Philadelphia.
TURBULENT FLOW OF NON-NEWTONIAN FLUIDS IN PIPES AND OPEN CHANNELS
Vanukuri Radha Krishan Murthy (Ph.D. Thesis) 1967 299 p
Avail: Univ. Microfilms: HC $13.50/Microfilm $3.85 Order No. 68-9225

The primary objective of this study has been to formulate analytically a technique which enables the engineer to predict the velocity profile and head loss or pressure drop in turbulent flow of purely viscous non-Newtonian fluids in smooth pipes and open channels of circular cross section. Of particular interest are the fluids in which the shear stress-shear rate (of strain) relationship can be approximated by the Ostwald-deWaele power law model. In the present study, the equations of motion for the turbulent flow of non-Newtonian fluids are derived incorporating a physical hypothesis of viscous interaction suggested by Zandi Rensselaer and Rust. This hypothesis postulates that the viscous forces in the turbulent core are not negligible and perhaps play an important role in the mechanism of turbulent flow. Similarly the turbulent eddies influence the viscous sub-layer adjacent to the solid boundary. Dissert. Abstr.

N69-17749# Boeing Co., Renton, Wash. Commercial Airplane Div.
A PROGRAM OF THEORETICAL RESEARCH ON HYDROELASTIC STABILITY Final Report
William S. Rowe and Trent B. G. Marvin Nov. 1968 85 p refs
(Contract N00014-67-C-0248)
(AD-679632; D6-19395) Avail: CFSTI CSCL 20/4

A correlation study has been performed between experimental hydrofoil flutter data and the aerodynamic flutter prediction techniques used in the aerospace industry. The use of current theoretical flutter prediction techniques produces flutter speeds that are unconservative when compared with the experimental data. This apparent failure to properly predict the flutter speed is not due to a failure of the theory itself, but is attributed to flow instability problems associated with the physical characteristics of the hydrodynamic profiles used in the flutter experiments. Author (TAB)

N69-17751*# Pratt and Whitney Aircraft, East Hartford, Conn.
ANALYTICAL AND EXPERIMENTAL STUDY OF THE DYNAMICS OF A SINGLE-TUBE COUNTERFLOW BOILER
H. L. Hess, J. R. Hooper, and S. L. Organ Washington NASA Feb. 1969 196 p refs
(Contract NAS3-9420)
(NASA-CR-1230) Avail: CFSTI CSCL 20D

An analytical and experimental study of a single tube counterflow boiler was conducted. The boiler geometry simulated one of the tubes of a typical boiler for a Rankine cycle space powerplant. Steady state, frequency response, and step response tests were conducted using water as the working fluid. The frequency response and step response tests were conducted by perturbing the boiling fluid flow rate at the inlet to the boiler. Experimental transfer functions were obtained from the frequency response test results. A linearized analysis of the boiler dynamics was performed to derive a theoretical expression for the boiling fluid exit pressure transfer function. A comparison was made between the theoretical and experimental transfer functions. Author

N69-17779*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FREQUENCY RESPONSE OF A FORCED FLOW SINGLE TUBE BOILER WITH INSERTS AND EXIT RESTRICTION
Grady H. Stevens, Eugene A. Krejsa, and Jack H. Goodykoontz Washington Feb. 1969 43 p refs
(NASA-TN-D-5023) Avail: CFSTI CSCL 20M

The frequency response technique was used to measure some of the dynamic properties of a heat exchanger boiler. The boiling fluid, Freon-113, exhausted through an orifice to a constant pressure. The boiling fluid inlet flow rate was varied sinusoidally about a mean value. The magnitude and phase of the perturbations of the boiler inlet flow, inlet pressure, and orifice pressure drop were measured. The data were used to compute the boiler inlet impedance (the complex ratio of the perturbations of inlet pressure and inlet flow) and the transfer impedance (the complex ratio of the perturbations of orifice pressure drop and boiler inlet flow). Author

N69-17792*# Aerotherm Corp., Palo Alto, Calif.
FURTHER STUDIES OF THE COUPLED CHEMICALLY REACTING BOUNDARY LAYER AND CHARRING ABLATOR. PART 4: NONSIMILAR SOLUTION OF AN INCOMPRESSIBLE TURBULENT BOUNDARY LAYER BY AN INTEGRAL MATRIX METHOD
Larry W. Anderson and Robert M. Kendall 15 Oct. 1968 58 p refs
(Contract NAS9-6719)
(NASA-CR-92474; REPT-68-38-Pt-4) Avail: CFSTI CSCL 20D

A numerically-accurate solution technique is introduced for the prediction of constant property turbulent boundary layer characteristics. The procedure can be termed a strip integral technique in that approximating functions (splined cubics) are used to represent the primary variables across boundary layer strips, and the governing equations are integrated across the strips. That is, squarewave weighting functions are used in forming the integrals of the governing equations. Derivatives in the normal direction are related to one another by Taylor series truncated to reflect the cubic approximation. Implicit quadratic finite difference relations are used to express streamwise derivatives for nonsimilar solutions. The turbulent model employs the idea of a wall and a wake region. In the wall region, a mixing length model for eddy viscosity is used, the mixing length being described by a first-order differential equation. The effects of wall injection or suction are considered in the mixing length equation. The wake region model employs a constant eddy viscosity at each streamwise station. Eddy viscosity in this region is taken to be proportional to the free stream velocity and the displacement thickness. Author

N69-17800# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING NOZZLE THRUST BY FLOW ROTATION
I. N. Naumova and Yu. D. Shmyglevskii Apr. 1968 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhnika Zhidkosti i Gaza (USSR), no. 1, 1967 p 34–37
(AD-679803; FTD-HT-23-225-68) Avail: CFSTI CSCL 20/4

An analysis was made of the thrust obtainable with a rotating gas stream. A formula was obtained for the overall thrust. TAB

N69-17808# Gulf General Atomic, San Diego, Calif.
AN EULERIAN METHOD FOR CALCULATING STRENGTH DEPENDENT DEFORMATION. PART 1: A DERIVATION FOR THE FLOW EQUATIONS FOR STRENGTH DEPENDENT DEFORMATION
J. K. Dienes 2 Feb. 1968 17 p refs
(Contract DA-04-495-AMC-1481(X); ARPA Order-71-62)
(AD-678565; GAMD-8497-Pt-1) Avail: CFSTI CSCL 20/4

Equations for the motion of a continuous medium capable of supporting shear stresses are reported by a number of authors, but the complete set does not appear to have been published in a form suitable for solution by Eulerian hydrodynamic codes. Specifically, the Eulerian equations of motion for a compressible medium acted upon by a general stress tensor are required. In this volume the equations of motion are discussed starting from the principles of mass, momentum and energy conservation for finite masses. From these the differential equations of motion are derived. The constitutive equations relating stress and strain are required to complete the mathematical description. It is also shown that the difference equations for hydrodynamic codes can be conveniently obtained from the integral form of the conservation laws. The nature of a medium is specified by its equation of state, which is used to calculate the pressure from the density and specific internal energy, and a tensor constitutive equation relating deviator stresses, deviator strains and their rates. Constitutive equations for the shear stresses are discussed and the appropriate forms for elastic, elastic-plastic and rigid-plastic solids as well as for viscous fluids are presented. Author (TAB)

N69-17809# Gulf General Atomic, San Diego, Calif.
AN EURLERIAN METHOD FOR CALCULATING STRENGTH DEPENDENT DEFORMATION. PART 2: DESCRIPTION OF THE FINITE DIFFERENCE EQUATIONS
J. M. Walsh, M. W. Evans, and J. K. Dienes 2 Feb. 1968 32 p refs
(Contract DA-04-495-AMC-1481(X); ARPA Order-71-62)
(AD-678566; GAMD-8497-Pt-2) Avail: CFSTI CSCL 20/4

In the past four years several authors have reported Eulerian hydrodynamic codes for the computation of compressible fluid flows in which the independent variables are two space dimensions and time. The present paper describes the generalization of such a code to include also the forces due to strength which arise within the material to resist shear deformation. In choosing the precise model for such a generalization, it is useful to recall that Eulerian codes have proven to be especially suited to the description of flows in which material elements undergo extreme distortion. It is in precisely this area of treating extreme distortions that Lagrangian codes, despite their success in treating other aspects of strength-dependent deformation, encounter serious difficulties. In order, then, to fill the apparent need for a strength code which is capable of the simple and efficient computation of flows involving large deformations, the present code development was initiated in 1965. The code has subsequently been the subject of continuing development during the course of a number of applications. Author (TAB)

N69-17810# Gulf General Atomic, San Diego, Calif.
AN EULERIAN METHOD FOR CALCULATING STRENGTH DEPENDENT DEFORMATION. PART 3: THE FORTRAN 4 PROGRAM AND INSTRUCTIONS FOR ITS USE
J. K. Dienes, M. W. Evans, L. J. Hageman, W. E. Johnson, and J. M. Walsh 2 Feb. 1968 176 p refs
(Contract DA-04-495-AMC-1481(X); ARPA Order-71-62)
(AD-678567; GAMD-8497-Pt-3) Avail: CFSTI CSCL 20/4

The computer program is listed in detail and the general information necessary to set up and run problems is provided. A dictionary of terms used in the program is also included, as well as a number of tables and charts describing the program in outline form. Forms for setting up a sample problem are also given. This information provides the user with a capability to run his own problems and, in addition, the intent is to describe the code in enough detail that any changes the user may require can be readily made. Author (TAB)

N69-17811# Gulf General Atomic, San Diego, Calif.
AN EULERIAN METHOD FOR CALCULATING STRENGTH DEPENDENT DEFORMATION. ADDENDUM TO REPORT ON THE OIL-RPM COMPUTER CODE
J. K. Dienes and L. J. Hageman 2 Feb. 1968 30 p
(Contract DA-04-495-AMC-1481(X); ARPA Order-71-62)
(AD-678568; GAMD-8497-Add) Avail: CFSTI CSCL 20/4

This addendum describes a number of improvements to the version of OIL-RPM documented in GAMD-8497. In EDIT and MAP the changes represent primarily a streamlining of the program. The small change to CDT ensures stability in a more rational manner. The requirements for enlarging the grid are also described, and a flow chart of the equation of state subroutine (ES) is included. Author (TAB)

N69-17827*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ELLIPSOIDAL VELOCITY DISTRIBUTION FUNCTION
N. Stankiewicz Washington Feb. 1969 18 p refs
(NASA-TN-D-5026) Avail: CFSTI CSCL 20D

An ellipsoidal velocity distribution function is found as the result of maximizing the entropy with constraints on the number density, the mean velocity, and the stress energy tensor. The relation of this function to the macroscopic flow equations (continuity, momentum, etc.) is studied. The special case of one dimensional channel flow is analyzed. It is shown that the ellipsoidal distribution function gives a consistent description of viscous flow. That is, the parabolic flow profile and Newton's law of viscosity become natural consequences of the macroscopic flow equations. Author

N69-17848# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
ON TWO DIMENSIONAL INCOMPRESSIBLE STEADY STATE FLOWS WITH SEPARATION
Alexander Pal (Ph.D. Thesis—New York Univ.) Oct. 1968 141 p refs
(Contract Nonr-839(38); Proj. Strategic Technology; ARPA Order 529)
(AD-679652; PIBAL-68-29) Avail: CFSTI CSCL 20/4

Contents: Formulation of the minimum problems; Convergence of the minimizing sequence; Topological properties of the solution; Integral equation and applications. TAB

N69-17937 California Univ., Berkeley.
FLOW AND HEAT TRANSFER TO SUBSONIC AIR FLOW IN A RECTANGULAR NOTCH
Parviz Payvar (Ph.D. Thesis) 1967 219 p
Avail: Univ. Microfilms: HC $9.90 /Microfilm $3.00 Order No. 68-10392

The problem of separated flow in a fence-model rectangular notch and the heat transfer associated with such a flow is considered. The flow is described by the results of measurements of total pressure, static pressure, mean and fluctuating velocities across several transverse sections of the cavity. The experimental data is found to be consistent with the equations of momentum and conservation of mass. An examination of the analytical solutions of separated flow fields that are based on the integral forms of the equations of continuity and momentum indicate that such solutions are inadequate and that they involve somewhat arbitrary assumptions. The thermal behavior of the cavity is described by the measurements of the heat transfer coefficients along the floor of the cavity and the temperature profiles across several transverse sections of the cavity. It is shown that the analogy methods that are applicable in predicting the heat transfer produced by turbulent boundary layers are not applicable to the heat transfer from the heated cavity wall. Dissert. Abstr.

N69-17959# United Kingdom Atomic Energy Authority, Risley (England). Authority Health and Safety Branch.
CONDUCTION CONTROLLED FLASHING OF A FLUID, AND THE PREDICTION OF CRITICAL FLOW RATES IN A ONE-DIMENSIONAL SYSTEM
A. R. Edwards 1968 67 p refs
(AHSB(S)R-147) Avail: CFSTI

At present, the prediction of critical flows from large diameter pipes, which in reactor situations tend to have low length-diameter (L/D) values, is very uncertain. The assumption that the same discharge rate per unit area is obtained for equal L/D ratios is generally used. In this report a theory and calculation method, based on the concept of bubble growth being controlled by heat conduction through the surrounding liquid layer is developed. Correlations for coefficients controlling the number of bubbles present and the time delay in their formation are deduced from experimental work on small diameter (1/4 in.) pipes with L/D less than 20; these are then used in the prediction of the critical discharge of larger diameter pipes. The theory may be used for sub-cooled, saturated or low quality two phase entry flows, with sharp-edged or radiused entries. The discharge rates predicted by this theory are much lower than those obtained by the use of L/D scaling, in some cases by as much as a factor two. Author (NSA)

N69-17974# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHARACTERISTICS OF THE BOUNDARY LAYER ON A CONE IN A ROTATING FLUID
A. V. Kolesnikov 4 Apr. 1968 21 p refs Transl. into ENGLISH from Prom. Aerodinam. (USSR), no. 28, 1966 p 86-97
(AD-679498; FTD-HT-23-1514-67) Avail: CFSTI CSCL 20/4

In the case in question, the velocity profile of the laminar boundary layer is determined by a method analogous to the Pohlhausen method for a plane boundary layer. The system of integral relationships can be reduced to a system of two equations, of which one is algebraic and the other is a nonlinear ordinary differential equation of the first order. A diagram of the problem is shown. The article concludes with a calculation of the characteristics of the turbulent boundary layer in the case of an exponential velocity profile with an arbitrary power exponent. Author (TAB)

N69-17985 Louisiana State Univ., Baton Rouge. Agricultural and Mechanical College.
ON A NEW APPROACH TO RAREFIED FLOW WITH APPLICATIONS TO CERTAIN CLASSICAL PROBLEMS
Edwin Price Russo (Ph.D. Thesis) 1968 114 p
Avail: Univ. Microfilms: HC $5.60 /Microfilm $3.00 Order No. 68-10759

The application of a new mathematical technique to the solution of rarefied flow problems in the slip flow regime is presented. The analysis is based on a new approach to applying the boundary condition in the conventional manner, a slipping surface is superimposed on a fictitious, continuum, nonslipping surface. These surfaces are separated by a distance which is proportional to

the degree of slip. This approach is very desirable since it provides solutions without encountering the mathematical difficulties of solving a partial differential equation with nonhomogeneous boundary conditions. Dissert. Abstr.

N69-18025*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PROGRAM FOR COMPUTING SHOCK-TUBE GASDYNAMIC PROPERTIES
T. E. Horton and W. A. Menard 15 Jan. 1969 84 p refs
(Contract NAS7-100)
(NASA-CR-99337; JPL-TR-32-1350) Avail: CFSTI CSCL 20D

A computer program for calculating the chemical equilibrium properties associated with moving, standing, and reflected normal shocks has been developed. The program calculates thermodynamic properties and chemical composition from basic spectroscopic data. Both dissociation and ionization over an unlimited temperature range can be considered. The chemical equilibrium and composition equations are developed from statistical mechanics, and the procedure for solving the coupled equilibrium and normal shock equations is presented. Flow diagrams, operating instructions, and listings of the program and input data are included. The program can treat initial mixtures consisting of up to 10 gases. In this report, input data are listed for 66 species which are composed of carbon, nitrogen, oxygen, hydrogen, argon, neon, and helium. Author

N69-18040 Florida Univ., Gainesville.
VISCOSITY OF LIQUID MIXTURES
Thomas Elliott Taylor (Ph.D. Thesis) 1967 106 p
Avail: Univ. Microfilms: HC $5.00*/Microfilm $3.00 Order No. 68-9489

The viscosities of 10 binary liquid systems have been determined as a function of composition and of temperature in the range 25° to 45°C. The thermodynamics of these systems range from the ideal solution to partially miscible liquids.) Based upon the absolute reaction rate theory of Eyring, these systems have been divided into three classes which differ in the dependence of the temperature coefficient of viscosity on temperature. It is found that as the temperature is decreased to approach the two-liquid phase region of a mixture, the viscosity as a function of composition displays an abnormally high value. This analysis shows that the enthalpy of activation for all solutions may be considered as essentially independent of temperature even though the temperature coefficient of viscosity varies with temperature. Dissert. Abstr.

N69-18110*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF CHARACTERISTICS FOR NUMERICAL CALCULATION OF SPATIAL FLOWS OF GAS
K. M. Magomedov 8 May 1967 26 p refs Transl. into ENGLISH from Zh. Vychislitelnoy Mat. i Mat. Fiz. (USSR), v. 6, no. 2, 1966 p 313–325
(AD-679555; FTD-MT-66-131) Avail: CFSTI CSCL 20/4

A number of methods of characteristics for numerical calculation of three-dimensional supersonic flows or unsteady two-dimensional problems of gas dynamics are evaluated and their complexity stressed. A new approach is outlined by which relative simplicity and uniformity are attained. The equations of a steady three-dimensional supersonic flow are transformed to an equivalent characteristic form which is not the only possible one. Therefore, a general form of characteristic correlations (compatibility conditions) is considered along a single-parameter family of bicharacteristics passing through a given point. It is demonstrated that an equation describing supersonic steady flow can be reduced by equivalent transformations to a system containing variables only along streamlines and bicharacteristic directions at a given point. It is also established that in contrast to a corresponding two-dimensional scheme, the order of difference approximations is reduced to the first order in the purely three-dimensional case. Difference equations are derived, and the parameters of the desired point are obtained from two correlations along streamlines and two along bicharacteristics. Four elementary problems are considered: determination of points inside the flow, on the surface of the body, on a shock wave, and on a free surface. Author (TAB)

N69-18127 Oklahoma State Univ., Stillwater.
INITIATION OF INTERFACIAL TURBULENCE IN LIQUID–LIQUID SYSTEMS
Richard Donald Skinner (Ph.D. Thesis) 1967 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8497

A modification of the flowing junction type diffusion cell and a birefringent interferometer were developed for the study of interfacial turbulence in immiscible liquid–liquid systems. A study was made to evaluate the causes of interfacial turbulence when uranyl nitrate is transferred from an aqueous phase into an organic phase (30 percent TBP and 70 percent n-heptane). An interfacial turbulence system of toluene–acetone–water was used during the development of the cell and the experimental procedure. All of the TBP–n–heptane–uranyl nitrate–water systems tested were found to have a potential for instability of the stationary type. However, interfacial turbulence was experimentally observed only in those system where the step change in uranyl nitrate concentration across the interface was sufficiently large. Dissert. Abstr.

N69-18139 Southern Methodist Univ., Dallas, Tex.
SYMMETRICAL AND UNSYMMETRICAL FLOW SEPARATION IN SUPERSONIC NOZZLES
Roy Albert Lawrence (Ph.D. Thesis) 1967 210 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-9667

Flow separation in supersonic nozzles was investigated to determine the characteristics and cause of unstable and unsymmetrical flow behavior which occurs at low chamber pressures, and to resolve the reasons for the difference between separation correlations for contoured nozzles as opposed to those for conical nozzles. The flow structure in several contoured and straight-walled, two-dimensional nozzles was examined by means of schlieren photography with single-frame and high-speed motion picture cameras, and with short-exposure shadowgraphs. Symmetrical, unsymmetrical and unstable separation in contoured and conical axi-symmetric nozzles was investigated by making transient and time-average measurements of static pressures along several sides of the nozzle walls simultaneously. Dissert. Abstr.

N69-18150*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y. Aerodynamic Research Dept.
RESEARCH ON HYPERSONIC CONDENSATION PHENOMENA IN HIGH TEMPERATURE GASES. VOLUME 1. MERCURY CONDENSATION EXPERIMENTS Final Report, Feb. 1962–Apr. 1968
Gordon E. Merritt Aug. 1968 70 p refs
(Contract AF 33(657)-8302)
(AD-680003; CAL-AD-1672-A-4-VOL-1; ARL-68-0142-VOL-1) Avail: CFSTI CSCL 20/4

The report describes experimental studies of the growth of mercury drops in continuous supersonic and subsonic flows. By comparing the amounts of mercury collected by pitot probes of different sizes, the diameters of the mercury drops were determined as they grew from 0.3 to 0.7 microns. The pitot probes were shown to be capable of detecting and measuring the amount of condensation even when less than 1% of the mercury had condensed. The measured condensation rates in the nitrogen carrier gas-mercury vapor atmosphere agreed well with theory provided that a value of 0.4 to 0.5 was assumed for the sticking coefficient of mercury atoms striking the drops. Author (TAB)

N69-18205*#
ON THE QUESTION OF DETERMINING THE SHOCKWAVE IN NONLINEAR PROBLEMS OF ELASTICITY THEORY

A. G. Bagdoev et al [1968] 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Mekh. (Erevan), v. 21, no. 3, 1968 1968 p 19–24
Avail: CFSTI

Some one dimensional and quasi-one dimensional problems of nonlinearly elastic and nonlinearly geometric bodies are considered. Solutions to shock equations are derived for materials which are viscoelastic and have cylindrical and spherical symmetry. B.P.

N69-18226# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
INFLUENCE OF A SHARP PRESSURE VARIATION ON A TURBULENT BOUNDARY LAYER AND APPLICATION TO HYPERSONIC AIR INTAKES [ACTION D'UNE VARIATION BRUSQUE DE PRESSION SUR UNE COUCHE LIMITE TURBULENTE ET APPLICATION AUX PRISES D'AIR SUPERSONIQUES]
J. Délery and B. Masure 1968 10 p refs In FRENCH; ENGLISH summary Presented at the 6th Intern. Congr. of Aeron. Sci., Munich, 9–13 Sep. 1968 Submitted for publication
(ONERA-TP-606) Avail: CFSTI

During the operation of the air intake of a hypersonic ramjet appear complex interaction phenomena between boundary layers and rapid expansions or shock waves. This paper shows the main results of the systematic study of the behavior of a thick turbulent boundary layer submitted to the intense and localized pressure gradients created by a step at the wall or by a shock wave. This study has been carried out experimentally and theoretically, and has led to the development of computation methods which appear to be satisfactory. Author (ESRO)

N69-18231# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
APPROXIMATE SOLUTIONS OF THE BOLTZMANN EQUATION FOR FLOW PAST BODIES OF MODERATE CURVATURE
Jean Sylvestre Darrozes 1968 11 p refs Presented at the Intern. 6th M.I.T. Symp. on the Dyn. of Rarefied Gases, Cambridge, Mass. 22–26 Jul., 1968 Submitted for publication
(ONERA-TP-613) Avail: CFSTI

A monoatomic perfect gas is flowing around a body of moderate curvature. Only the steady near continuum regime is investigated and the Knudsen number is a small parameter corresponding to a singular perturbation problem for the Boltzmann equation. The approximate solutions are obtained under the form of matched asymptotic expansions. The whole flow is described with three regions (outer, intermediate and inner expansions) corresponding respectively to the inviscid region, the boundary layer and the Knudsen layer. Author (ESRO)

N69-18257# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
STUDY BY HYDRAULIC ANALOGY OF WAVE CONFIGURATIONS IN SUPERSONIC COMPRESSORS [ETUDE PAR ANALOGIE HYDRAULIQUE DE LA CONFIGURATION D'ONDES DANS LES COMPRESSEURS SUPERSONIQUES]
Roland Sovrano and Yves le Bot 1968 16 p refs In FRENCH; ENGLISH summary Presented at the 32nd AGARD Propulsion and Energetics Group Meeting on the Components of Advanced Technol. for Turbojets Submitted for publication
(ONERA-TP-598) Avail: CFSTI

The theoretical studies of wave patterns (shock or expansion waves) in supersonic compressors are difficult due to the three-dimensionality of the flow. Hydraulic analogy is used in an experimental set-up of a rotating annular cascade in a free surface water-tank where the shock wave and the expansion line pattern in the front of the cascade are visualized. The cascade rotates with a velocity larger than the surface waves velocity. On account of the periodicity of the blades, such a set-up gives flow patterns encountered in actual axial compressors. Two different flow models are analyzed: conventional supersonic compressors with subsonic axial flow velocity, similar to the transonic aircraft compressors and advanced supersonic compressors with supersonic axial flow velocity, well adapted to high Mach number aircrafts. In both cases, experiments are showing a high flow incidence angle at the cascade inlet and normal shock waves in the blade channels. Author (ESRO)

N69-18268# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
MIXING REGIMES OF TWO STREAMS WITH DIFFERENT TOTAL ENTHALPIES [REGIME DE MELANGE DE DEUX FLUX D'ENTHALPIES D'ARRET DIFFERENTES]
Emile Le Grives 1968 14 p refs In FRENCH; ENGLISH summary Presented at the 32nd AGARD Propulsion and Energetics Group Meeting on the Components of Advanced Technol. for Turbojets Submitted for publication
(ONERA-TP-599) Avail: CFSTI

Analysis of the various regimes of mixing of coaxial such as occur in a variety of jet engines can be based on the aerodynamical theory of ejectors, which shows the requirements for compatibility of two streams flowing in the same duct. The basic modes of coexistence should be identified in view of practical effects such as thermal stresses, or performance instabilities and limitations in air-breathing thrusters. One dimensional analysis leads to a satisfactory description of the supersonic regime, when the primary stream expansion controls the mass flow rate of a subsonic secondary stream, or of the mixed flow with or without downstream choking. A set-up including an arc-heater fed with air has been used for experimental research on downstream choking. Theoretical predictions are checked accurately for moderately long mixing-tubes. Author (ESRO)

N69-18290# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
THE LAMINAR NEAR WAKE BEHIND A SLENDER WEDGE AT SUPERSONIC SPEED AND HIGH REYNOLDS NUMBER
Ching-Ju Chang and Arthur F. Messiter Nov. 1968 175 p refs
(Contract DAHC15-67-C-0062; ARPA Order 236)
(AD-678587; Rept-8430-2-T) Avail: CFSTI CSCL 16/4

The theoretical study presented is concerned with predicting the flow details in the region immediately behind a slender wedge moving at supersonic speed. An asymptotic solution is obtained for the laminar near wake, which is valid in the limit as Reynolds number based on external flow properties tends to infinity, with the external Mach number held fixed. In this limit, the interior of the recirculating flow is approximately incompressible and inviscid; the viscous layer is a continuous thin layer with large transverse velocity gradient; and the typical velocity of the recirculating flow must be of the same order as that of the external flow, although numerically it is small. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-17214# Tokyo Univ., (Japan). Inst. of Space and Aeronautical Science.
ENERGY TRANSFER ACROSS THE MAGNETOSPHERIC BOUNDARY: A COMPUTER SIMULATION OF THE CROSS-FIELD HEAT TRANSFER IN A COLLISIONLESS PLASMA

Tatsuzo Obayashi and Takeo Tsuda (Kyoto Univ.) Sep. 1968 12 p refs Presented at Symp. on Computer Simulation of Plasma, Kyoto, Jan. 1966 *Its* Vol. 33, No. 11
(ISAS-429) Avail: CFSTI

A computer experiment has been made, simulating the condition of the earth's magnetospheric boundary where an appreciable flow of energy is entering to the magnetosphere from the high temperature domain of the solar wind. A one-dimensional sheet model is employed and the rate of heat energy flow is computed for the collisionless plasma in which the particles are transported across the static magnetic field. It is shown that the effective transfer rate of heat energy across the magnetic field can attain the value of 10^8 times as large as that estimated by the classical formulas of transport phenomena. An interpretation on the physical mechanism is suggested in terms of the wave-particle interactions in the collisionless regime. The manner in which magnetic turbulences generated at the magnetopause act to destroy the anisotropy of diffusion is shown. Author

N69-17226 Pennsylvania State Univ., University Park.
DENSITY AND TEMPERATURE FLUCTUATIONS IN THE DAYTIME F REGION OF THE IONOSPHERE
Joe Robert Doupnik (Ph.D. Thesis) 1967 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-8683

Large amplitude electron density and temperature fluctuations in the daytime F region were observed at Puerto Rico during incoherent backscatter experiments on quiet days. Mechanisms for causing the fluctuations were investigated by examining electron density and temperature instabilities, variations of solar ionizing radiation, motions of the neutral atmosphere in the forms of gravity waves and winds, electrodynamic drifts associated with the dynamo current system, local drifting irregularities, and large traveling disturbances. Model computations of separate density and temperature profiles indicated that instabilities of the coupled density-temperature system were found not to be responsible for the fluctuations. Local drifting irregularities and solar flux variations were shown to be not responsible by data from a network of spaced ionosondes. Electrodynamic drifts associated with the dynamo current system were shown to be at variance with vertical transport velocities computed from the experimental backscatter data. Dissert. Abstr.

N69-17232# Wisconsin Univ., Madison. Dept. of Meteorology.
STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS Annual Report
Verner E. Suomi May 1968 231 p refs
(Grant CWB-WBG-27)
(PB-180267) Avail: CFSTI CSCL 04B

The development introduces a technique for measuring cloud velocities from sequences of ATS photos. A comparison is made between cloud velocity measurements and corresponding rawinsonde wind measurements to test the usefulness of the technique of determining the wind velocities from selected cloud velocities. Author (USGRDR)

N69-17296# Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENT OF THE DIFFUSION OF CELESTIAL LIGHT USING BALLOONS, PART 1 [MESSUNG DES DIFFUSEN HIMMELSLICHTES MITTELS BALLONEN, TEIL 1]
F. Roessler and D. Bock 19 Oct. 1967 41 p refs In GERMAN
(Contract T-756-I-206)
(ISL-10/67-Pt-1) Avail: CFSTI

Diffuse sky light measurements from 4 ballon flights over Germany are presented. Example data reduction techniques and a discussion of the results are included. Measurements were obtained at a height of 26 km; a maximal dust layer was observed at 16 km heights. Transl. by G.G.

N69-17335# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF AIR DENSITY ON THE BASIS OF CHANGES IN THE ORBITAL ELEMENTS OF ARTIFICIAL EARTH SATELLITES
M. Ill 16 Apr. 1968 12 p refs Transl. into ENGLISH from Nablyudeniya Iskusstvennykh Sputnikov Zemlin (USSR), no. 2, 1963 p 58-63
(AD-679511; FTD-HT-23-236-68) Avail: CFSTI CSCL 4/1

H. Philipps method of determining air density is used to derive simple formulas for determining air density and changes in air density. Author (TAB)

N69-17336*# Ohio State Univ., Research Foundation, Columbus.
SEQUENTIAL LEAST SQUARES ADJUSTMENT OF SATELLITE TRIANGULATION AND TRILATERATION IN COMBINATION WITH TERRESTRIAL DATA
Edward J. Krakiwsky Oct. 1968 334 p refs
(Grant NGR-36-008-093; OSURF Proj. 2514)
(NASA-CR-73907; Rept-114) CSCL 08E

An investigation was conducted to develop the detailed equations necessary for the sequential least squares adjustment of satellite triangulation and trilateration in combination with terrestrial data. The equations are then applied to particular terrestrial and satellite observables. A computerized system is developed to perform the necessary computations. Author

N69-17344# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
SEA AND SWELL FORECASTING Interim Report
N. A. Pore and W. S. Richardson Jan. 1969 22 p refs
(WBTM-TDL-17; IR-2) Avail: CFSTI

Work on sea and swell forecasting in the Techniques Development Laboratory from December 1967 to the time the method was put into operational use (October 1968) is described. Low level atmospheric stability was found ineffective in improving the wave forecast method. Constants of the relationship for wind-wave height forecasting have been slightly modified to forecast lower, more realistic values in the maximum wave areas. Wave height charts for operational use are described. Author

N69-17348 College of William and Mary, Williamsburg, Va.
LASER BACKSCATTER MEASUREMENTS OF THE LOWER ATMOSPHERE
Michael Patrick McCormick (Ph.D. Thesis) 1967 174 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-810

Laser backscatter measurements of the atmosphere to 28 km at 6943 Å have been used to develop a model for the clear atmosphere. Absolute volume backscatter cross sections and attenuation coefficients have been calculated using rigorous Mie theory for the aerosol component and Rayleigh theory for the molecular component. Aerosol scattering cross sections for a Junge size distribution have been computed for various atmospheric radii limits, size parameter increments, and size distribution parameters at four laser wavelengths for an index of refraction of 1.5. The measurements made for the clear atmosphere show excellent agreement with model calculations based on direct aerosol samplings and the Junge fourth power size distribution law. In addition, a number of observations of meteorological phenomena are included which demonstrate potential applications of laser radar to meteorological studies. Dissert. Abstr.

N69-17412*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
SOLAR X-RAY CONTROL OF THE E LAYER OF THE IONOSPHERE
P. R. Sengupta Jan. 1969 46 p refs
(Grant NGL-16-001-002)
(NASA-CR-73884; Rept-69-3) Avail: CFSTI CSCL 04A

Solar X-ray control of the E layer of the ionosphere is investigated. Electron production rates between 100 and 140 km above the earth due to 31–100 A° solar X-ray flux extrapolated from X-ray data recorded by Explorer 30, OGO-4, and OSO-4, and due to reported Lyman alpha flux from rocket and satellite experiments are calculated to show that about 70% of the E-layer ionization is contributed by the X-rays. Calculated E-layer electron densities due to solar X-ray flux on two typical days are compared with the E-layer electron density profile. It is concluded that 31–100 A° solar X-rays which contribute about 70% of the E-layer ionization on a day of moderate solar activity are responsible for day-to-day variations in the E-layer index. Contribution of 10–30 A° solar flux to the E-layer ionization is small except on a day of high solar activity. Author

N69-17434# Air Force Cambridge Research Labs., Bedford, Mass.
NUMERICAL EXPERIMENTS WITH A VERTICALLY PARAMETERIZED MODEL DESIGNED TO STUDY THE EFFECTS OF HIGH LEVEL HEATING ON THE LARGE SCALE CIRCULATION OF THE LOWER ATMOSPHERE Interim Scientific Report
Louis Berkofsky and Ralph Shapiro Nov. 1968 27 p refs /ts Environ. Res. Papers No. 294
(AD-679994; AFCRL-68-0571) Avail: CFSTI CSCL 4/2

Two series of numerical integrations are carried out with a vertically parameterized model which was designed for the purpose of studying the effects of high-level heating on the large-scale circulation of the lower atmosphere. The initial data required by the model are the surface temperature distribution, the vertically integrated streamfield, and the temperature distribution at the top of the atmosphere, which is taken to be 0.1 mb, about 65 km. The initial data for the surface temperature distribution and the vertically integrated streamfield are taken respectively from the observed surface and 500 mb northern hemisphere charts at the time of a large geomagnetic disturbance. This time is assumed to coincide with an influx of solar corpuscular radiation down to auroral levels. The corpuscular radiation perturbs the upper-level temperature distribution by superimposing upon a constant temperature of 247K (the undisturbed state) a temperature increment proportional to the observed auroral frequency distribution. The total heat input is modest, resulting in an average increment of about 7C in 24 hours at the 0.1 mb level. The results indicate that in this model significant changes in the large-scale tropospheric circulation can be produced by the type of upper-level heating introduced. The changes are consistent with what was expected from empirical studies, but improvements in the model are necessary before it can be concluded that such changes would constitute a response of the real atmosphere to a solar energy perturbation. Author (TAB)

N69-17455# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
SOME MEASUREMENTS OF SKY EMISSION IN THE 5-25 MICROMETER REGION
C. B. Arnold and F. S. Simmons Oct. 1968 21 p refs
(Contract DAHC15-67-C-0062; ARPA ORDER 236)
(AD-679587; REPT-8418-1-R) Avail: CFSTI CSCL 4/1

An experimental study of the thermal radiation from the atmosphere is described, and some preliminary results are presented. These consist of moderately low-resolution spectra obtained with the instrument looking directly upward for various clear-sky weather conditions at Willow Run, Michigan. Comparisons are made with spectra representing band-model predictions based on standard atmospheric temperature and water vapor profiles adjusted to values measured at ground level. The agreement is satisfactory in the centers of the molecular bands; the uncertainties in the 10-12-micrometer continuum region are discussed. Author (TAB)

N69-17560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBULENCE IN A CLEAR SKY
I. G. Pchelko et al. 6 Jun. 1968 24 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchno-Issled. Tsentr SSSR (USSR), no. 7, 1967 p 3–15
(AD-679885; FTD-MT-24-66-68) Avail: CFSTI CSCL 4/1

The results of a systematic and statistical study of clear air turbulence encountered along the main airline routes over the Soviet Union and the socialist countries of Eastern Europe are now available in summary form. The data were collected by crews of turboprop and turbojet aircraft, generally flying at altitudes of 6-10.5 km, for four 5-day periods (9-13 December 1964, 10-14 March, 9-13 June, and 8-12 September 1965). The data were grouped into four 6-hour daily observation periods (2400-0559, 0600-1159, 1200-1759, and 1800-2359 hr Greenwich time). Some of the results of a similar study made by Colson in 1962 for the United States, and those obtained in an earlier study by Soviet scientists, are compared with the data of the present study. Major aspects of the analysis include determination of (1) the probability of encountering turbulent zones in various regions of and altitudes above the area covered by the study, (2) the relationship of turbulence to wind speeds and directions, vertical wind shear, Richardson number, and horizontal wind shear. Data on actual encounters with turbulence are presented for the four 5-day periods in tables and are graphically portrayed on four small-scale maps. TAB

N69-17563# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL METHOD OF SOLVING THE NONLINEAR PROBLEM OF THE PASSAGE OF AN AIR CURRENT OVER IRREGULARITIES IN EARTH'S SURFACE
Ye. M. Pekelis 1 Apr. 1968 16 p refs Transl. into ENGLISH from Tr. Mirovoi Meteorol. Sentr. (Moscow), no. 6, 1965, p 57–64
(AD-679520; FTD-HT-23-1558-67) Avail: CFSTI CSCL 4/2

A numerical method for solving the nonlinear plane problem of the flow of an air current over irregularities on the earth is analyzed. The method suggested can be generalized without essential complications to cover the case of three three-dimensional variables. Author (TAB)

N69-17586# Air Force Cambridge Research Labs., Bedford, Mass.
HUMIDITY UP TO THE MESOPAUSE
N. Sissenwine, D. Grantham, and H. A. Salmela Oct. 1968 54 p refs /ts Surveys in Geophys. No. 206
(AD-679996; AFCRL-68-0550) Avail: CFSTI CSCL 4/1

The results of seventeen northern California soundings of humidity up to 25 to 30 km, generally a month apart, utilizing a high sophisticated alpha-radiation hydrometer and associated balloon sounding equipment are described. The stratosphere was never found to be near saturation as has been suggested by some investigators, nor was it as dry and completely devoid of variability as is indicated by most accepted circulation theory. A very dry layer was found above the tropopause, followed by a slight increase in humidity up to an average altitude of about 25 km. Above this level, a general decrease in water vapor with altitude was deduced. Variability in this region of the lower stratosphere approached a factor of 10. Spasmodic transfer of water vapor upward through the tropopause is suggested, and speculation related thereto provided. A model moisture profile is presented as an engineering reference standard. Typical dew point (or frost point) and mixing ratio profiles from the surface to 80 km for mid-latitudes are provided. The model is based on latest compilations of tropospheric and stratospheric humidity data up to 32 km and experimental rocket samplings of noctilucent clouds. Author (TAB)

N69-17588# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BEHAVIOR PATTERNS IN THE E_s LAYER IN THE AURORAL AND CIRCUMPOLAR REGIONS

G. N. Gorbushina 29 May 1968 20 p refs Transl. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchno-Issled. Inst. (Lenigrad), v. 280, 1966 p 91–99
(AD-679795; FTD-MT-24-117-68) Avail: CFSTI CSCL 4/1

The sporadic E layer is observed over all regions of the earth, but its form differs from place to place, and a classification of the Es layer, based on differences in the external appearance of recordings of reflections on ionograms, has been developed. Three primary classes of sporadic layers are differentiated: the flat Es layers (types l, c, h and f), which are usually semitransparent, resulting in partial reflection of radio waves; Es layers with group delay and magnetoionic splitting (E nocturnal and Es type r); and diffuse Es layers (types a, q and s). These primary types of Es layers are described, and the distribution by latitudes, as observed at various times of day, are presented graphically. Data are presented for latitudes of 60 deg and higher. TAB

N69-17619# Hydronautics, Inc., Laurel, Md.
WAVE SLOPES, ACCELERATION AND VELOCITY OF THE OCEAN SURFACE—MEAN SQUARE SPACE AVERAGES
K. K. Wong Jun. 1968 74 p refs
(Contract Nonr-4769(00))
(AD-679696; TR-513-4) Avail: CFSTI CSCL 8/3

The main objective of this investigation was to interpret and present the results of field measurements made by the National Institute of Oceanography, using a cloverleaf buoy and to compare these results with a development of a semi-empirical method for estimating the expected space average slope, vertical acceleration and velocity of the ocean surface for any given wind condition. Results of the chi-square test indicate that the distribution of slopes is in general Gaussian, while the acceleration distribution frequency shows non-Gaussian behavior. It was concluded that (1) the assumption of the wave system being composed of non-interacting linear deep water gravity waves with random phasing seems reasonable, that (2) the cosine square law for the angular dependence did not seem to be substantiated, and that (3) Phillips spectrum may be used to estimate the space average values of the total slope and acceleration for higher wind conditions. Author (TAB)

N69-17645# Northwestern Univ., Evanston, Ill. Dept. of Geography.
COMPUTER PROGRAMS FOR THE OPERATIONAL ANALYSIS OF HAGERSTRAND TYPE SPATIAL DIFFUSION MODELS
Duane F. Marble and Sophia R. Bowlby Feb. 1968 44 p refs
(Contract Nonr-1228(33))
(AD-679582; TR-9) Avail: CFSTI CSCL 8/6

Previous technical reports have presented computer programs for the implementation of Hagerstrand type models of spatial diffusion on regular and irregular lattices. Since these models are of a Monte Carlo nature, multiple runs are necessary in order to establish expected values and estimates of the degree of variation to be expected. This report presents modified versions of the two major generating programs (HAGER III and NONCELO which have been redesigned for multiple run output on binary magnetic tape. In each case two reduction routines, one providing temporal summaries and the other spatial summaries, are also provided. Output samples and source deck listings in FORTRAN IV for the CDC 3400 are given for all programs. Author (TAB)

N69-17654# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADON CONCENTRATION AND VERTICAL TURBULENT MIXING IN THE LOWEST ATMOSPHERIC LAYER
V. B. Milin et al 9 Feb. 1968 13 p refs Transl. into ENGLISH from the Russian
(AD-679719) FTD-HT-23-1168-67) Avail: CFSTI CSCL 4/1

The results are described of an analysis of simultaneous measurements of radon concentration in the surface boundary layer of the atmosphere (low-temperature radon-concentration determination using liquid nitrogen and the activated carbon-absorption method) and in the soil, the amount of radon exhaled from the surface, and the coefficient of vertical turbulent mixing. Two series of measurements were made -- one 7 km south of Kirov in the summer of 1950 mainly under convective conditions, and the second in the Moscow region in the summer of 1962 with a surface boundary layer inversion. The effect of vertical turbulent mixing on the concentration of radon in the surface boundary layer was determined to be of major significance. Author (TAB)

N69-17673# Boston Coll., Chestnut Hill, Mass.
EVALUATION OF SEISMIC INSTRUMENTS AND BASIC RESEARCH ON SEISMIC WAVE PROPAGATION Final Report, 1 Jun. 1966–31 Aug. 1968
John G. Hogan, Joseph J. Blaney, John F. Devane, Thomas E. Foley, William E. Haynes et al Oct. 1968 114 p refs
(Contract AF 19(628)-6067, ARPA Order 292; Proj. Vela-Uniform)
(AD-679558; AFCRL-68-0589) Avail: CFSTI CSCL 8/11

Seismometer test procedures are presented. Results of the tests performed on the seismometers used in the portable seismic detection system are detailed. The results of frequency response tests performed on the portable seismic detection system are presented. Changes and modifications of the portable seismic detection system are described. Equipment additions to the Data Analysis Laboratory are described. A brief discussion of a program used to process data taken with the portable seismic detection system is given. A description of a quartz fiber tiltmeter and gravimeter developed during this contract is presented. Author (TAB

N69-17721# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESULTS OF MODEL EXPERIMENTS ON THE PROPAGATION OF A SETTLING ADMIXTURE IN THE LOWER LAYER OF THE ATMOSPHERE UNDER VARIOUS METEOROLOGICAL CONDITIONS
N. L. Byzova et al Jan. 1968 16 p refs Transl. into ENGLISH from Radioaktiv. Izotopy Atmos. Ikh Ispol'z. Meteorol. Nauch. Konf. Yad. Meteorol., Obninsk, USSR, 1964 (Moscow), 1965 p 392–402
(AD-679740; FTD-MT-24-278-67) Avail: CFSTI CSCL 4/1

Further study and observation are needed to measure and calculate more scientifically the dispersal of gasses and smoke emanating from chimneys and carried by air currents. The Institute of Applied Geophysics used a 300 meter meteorological tower. Various heights of source were used and sticky surface plane tables were deployed in a radius of 10-20 km around the tower. Particles dispersed from a chimney source are carried by the wind and settle under influence of their weight. Information obtained thus far has been insufficient to permit deriving a formula for practical calculation of chimney heights for newly constructed enterprises and to determine the area of contamination. In the experiments, a polymethyl-methacrylate powder consisting of particles 10-100 microns in size was used as the contaminant. Tests were conducted under a variety of meteorological conditions both in summer and winter and during day and night. The effect of temperature inversions was found to have a significant effect on dispersal. Author (TAB)

N69-17783# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF THE BRIGHTNESS COEFFICIENT OF THE GROUND AND CLOUDS FROM AN AIRPLANE
I. N. Kostyanoi, G. N. Kostyanoi, and L. A. Pakhomova May 1968 20 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 66, 1965 p 63–72
(AD-679738; FTD-MT-24-83-68) Avail: CFSTI CSCL 20/6

The reflection ability of a surface is usually characterized by the albedo which is a ratio of the incident light to the light

reflected in all directions. The brightness coefficient can be used instead of the albedo. The brightness coefficient for various natural surfaces was determined from aerological and actinometric observation data obtained by airplane flights to a height of 6 km. The downward flow was measured with the help of a pyranometer installed above the aircraft fuselage, and the reflected radiation was measured by a special instrument fastened beneath the airplane. The reflected radiation was measured in absolute units. Flights took place above different ground and cloud areas. Coefficients computed from data obtained above water surfaces were represented graphically. TAB

N69-17833# Stanford Research Inst., Menlo Park, Calif.
LIDAR-RADAR LOWER ATMOSPHERIC OBSERVATIONS Final Scientific Report, 16 Oct. 1967–15 Oct. 1968
William Viezee and John Oblenas 15 Nov. 1968 69 p refs
(Contract F19628-68-C-0021)
(AD-679594; AFCRL-68-0586) Avail: CFSTI CSCL 17/8

Daytime observations of the vertical temperature and humidity structure in the atmosphere below 1000 meters made with a Cricketsonde rocket system are compared with simultaneous observations from a ruby lidar (laser radar) and a microwave K-band radar. Observations were made at the SRI field site in Palo Alto, California, during August 1968 in the absence of low clouds when haze and pollution were visually evident. Analyses of the data show a direct relationship between Cricketsonde and lidar data, an indirect relationship between Cricketsonde and K-band data, and no relationship between lidar data and K-band radar data. Author (TAB)

N69-17846*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF MEDIUM-RESOLUTION RADIOMETRIC DATA FROM NIMBUS 2
Paul A. Davis Nov. 1968 113 p refs
(Contract NAS5-10365)
(NASA-CR-73953) Avail: CFSTI CSCL 22/02

Variations of medium-resolution radiometric data from Nimbus II are compared with concurrent thermodynamic properties derived from conventional meteorological data. An infrared model for computing transmissions, radiances in particular spectral intervals, or total fluxes was completely revised and improved. Applications of the model to real data yield radiances that compare favorably with satellite data. In contrast to previous computations with data from a variety of locations at a fixed time, computations from a series of observations at a fixed location showed a high correlation between total outgoing flux and total infrared cooling for all cloud conditions. However, the correlation between radiometric measurements and the computed outgoing flux and, especially, total cooling, deteriorated as the cloudiness increased. The vertical distribution of the infrared cooling in the tropical Pacific between 7°N and 20°N showed a pronounced maximum in the upper troposphere at 7°N. Maintenance of the upper tropospheric temperature distribution demands a supply of heat at high levels there, presumably by convection and the release of latent heat (and, possibly, by eddy heat transports). Author

N69-17858# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEMS OF TROPOSPHERE AND STRATOSPHERE INTERACTION AT MIDDLE LATITUDES
B. N. Trubnikov et al 24 May 1968 20 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 69, 1966 p 44–52
(AD-679536; FTD-MT-24-80-69) Avail: CFSTI CSCL 4/1

A system of linearized equations is developed for the analysis of the interactions between the troposphere and the stratosphere. Ultimately, the meridional disturbance of the seasonal zonal state is described by a second-order differential equation with variable coefficients. Applied with modifications to the analysis of free atmospheric oscillations, it indicates that the existence of interrelated processes in the atmosphere and troposphere essentially depends not just on the scale of the process, but also on the mid-seasonal wind velocity and atmospheric stability. A coefficient of refraction from weather rocket data was calculated for mid-latitudes of the USSR, using the Rossby formula. Near the tropopause, this coefficient has a sharp discontinuity. A qualitative analysis of the coefficients distribution pattern enabled the modeling of the formation of barrier layers. It is conceivable that better understanding of the role of barrier layers will explain the formation of warmer regions at high altitudes and the explosive nature of energy expansion upwards. The calculation involving a rough approximation of the refraction factor indicates that the strong meridional winds at mid-latitudes of the European USSR may be caused by the expansion of the meridional component from the troposphere into the stratosphere. Author (TAB)

N69-17885*# Communication Systems, Inc., Falls Church, Va.
PROCEEDINGS OF THE GEOS PROGRAM REVIEW MEETING. VOLUME 2: GEOMETRIC AND GRAVIMETRIC INVESTIGATIONS WITH GEOS-1
Mar. 1968 124 p refs Proc. held in Washington, 12–14 Dec. 1967
(Contract NASw-1503)
(NASA-CR-73957) Avail: CFSTI CSCL 08N

Tracking and satellite data analyses for GEOS 1 are presented. Improved geodetic data and the exact positioning of stations are emphasized, and the determination of tesseral harmonics of the earth's gravitational field is described. Operations in collecting the data and various methods of reducing the data are discussed. N.E.N.

N69-17906# Institut Franco-Allemand de Recherches, St. Louis (France).
THE AEROSOL LAYER OF THE STRATOSPHERE [DIE AEROSOLSCHICHT DER STRATOSPHAERE]
F. Roessler 26 Jun. 1967 28 p refs In GERMAN
(ISL-T-22167) Avail: CFSTI

Aerosol layers observed during three upper atmosphere soundings over Hammaguir are compared with each other and evaluated. Corresponding radio sonde measurements and upper atmosphere weather charts are given. Comparison of obtained aerosol curves with literature on trapped, photometric evaluated, and counted aerosol particles established the height dependence of the aerosol layer on geographic latitudes. Layer heights decreases from the equator towards the poles similar to tropopause behavior. Transl. by G.G.

N69-17928*# Dartmouth Coll., Hanover, N. H. Radiophysics Lab.
AN EXPERIMENT TO STUDY WHISTLERS AND AUDIO-FREQUENCY EMISSIONS WITH A RECEIVING SYSTEM ON BOARD THE POGO S-50 SATELLITE (OGO-C/2) IN CONJUNCTION WITH AN EXISTING NETWORK OF GROUND-BASED OBSERVING STATIONS Final Report, 30 May 1963–24 Feb. 1968
M. G. Morgan and T. Laaspere 29 Feb. 1968 60 p refs
(Contract NAS5-3092)
(NASA-CR-97605) Avail: CFSTI CSCL 04A

Technical specifications developed by the contractor for the experiment are cited and a chronological account is given of the production of the experiment by a subcontractor and its acceptance by Goddard Space Flight Center. The launch and the results obtained with the experiment are described, and a paper discussing observations of lower-hybrid-resonance phenomena by Dartmouth's OGO-2 experiment is included. Consideration given to means of acquiring data from the spacecraft over Labrador is also described. Author

N69-17933*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF RESULTS OF EXPLORER 21 DIRECT MEASUREMENT PROBE

J. L. Donley, L. H. Brace, J. A. Findlay, J. H. Hoffman (Southwest Center for Advan. Studies), and G. L. Wrenn (Univ. Coll., Longon) Jul. 1968 31 p refs
(NASA-TM-X-63442; X-615-68-290A) Avail: CFSTI CSCL 04A

Intercomparison measurements of the major ionospheric parameters of ion and electron density and temperature and ionic species made by direct measurement probes on the Explorer XXXI satellite are presented. Plasma density results are compared with simultaneous data from the Alouette II satellite. Probe results are from the following experiments: planar ion trap, planar electron trap, cylindrical electrostatic probes, high resolution magnetic ion mass spectrometer, planar Langmuir plate, and spherical ion probe. The plasma density measured by the various probes generally agree with simultaneous Alouette II sounder values to within 20%. Electron temperatures measured by three different types of probes generally agree within 10%. Ion compositon measurements by the planar ion trap and spherical probe show good agreement with the high resolution magnetic mass spectrometer. Ion temperature measurements from the ion trap are consistently higher than spherical ion probe results. Author

N69-17936*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SIGNIFICANCE OF THE WAVE PICTURE IN THE THEORY OF DIURNAL TIDES WITHIN THE THERMOSPHERE
H. Volland and H. G. Mayr Dec. 1968 26 p refs
(NASA-TM-X-63410; X-621-68-466) Avail: CFSTI CSCL 04A

It is shown that the diurnal tides within the thermosphere are excited by solar EUV heat input and by a tidal gravity wave which is generated within the lower atmosphere and propagates upward into the thermosphere. Applying the concept of characteristic waves in a two dimensional model atmosphere it is possible to separate the contributions of the density and temperature variations due to the two energy mechanisms. As a consequence of this, the boundary conditions for the thermospheric tides can be unambiguously established. With help of such a model, valid at the equator between 100 and 400 km height, it is possible to explain the observed data of diurnal variations of density, temperature, and horizontal wind without requiring an additional second heat source within the thermosphere. The tidal wave from below predominates at lower altitudes and thus is primarily responsible for the relatively large density variations measured below 200 km altitude. At higher altitudes the thermospheric EUV heat source dominates. The time lag of the diurnal thermospheric density variation with respect to the solar EUV input is 2 hours which is in agreement with the observations. Author

N69-17961*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATISTICAL SPECIFICATION OF THE 500-mb HEIGHT FIELDS USING SMOOTHED MEDIUM-RESOLUTION RADIOMETRIC FIELDS OF NIMBUS 2
Frank L. Martin Oct. 1968 60 p refs
(NASA-TM-X-63400; X-622-68-399) Avail: CFSTI CSCL 08N

Over an area spanning the North American continent from tropical to polar latitudes, and between 40W and 135W, four consecutive days of the NIMBUS II MRIR five channel equivalent blackbody temperatures, and of 1000 mb geopotential fields were used to specify the 500 mb field of geopotential. Three of the four days were reserved for dependent data, and the fourth day was reserved for independent test case data. The data samples were stratified into extratropical and subtropical–tropical areas, and then pooled three day stepwise, screening regression equations were developed by areas. In the lower latitude stratifications, the 500 mb regression equations were only of marginal significance, but in the extratropical zone (latitudes 32–64 N), the regressions gave 500 mb height specifications with multiple correlation coefficients of 0.95. Moreover, in the independent data test case, no shrinkage of explained variances occurred in these extratropical latitudes. Here the most important predictors for Z_5 (I, J) were the equivalent blackbody temperatures (T_{BB}) in the 14 to 16 micron and 10 to 11 micron channels, the 1000 mb geopotential, and finally an effective T_{BB} associated with the solar reflectance channel. Author

N69-17977*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CAUSES OF SUDDEN COMMENCEMENTS AND SUDDEN IMPULSES
L. F. Burlaga and K. W. Ogilvie Jan. 1969 31 p refs
(NASA-TM-X-63448; X-616-69-28) Avail: CFSTI CSCL 04A

The causes of 19 worldwide changes in the earth's magnetic field, occurring between June and December 1967, were determined by examining magnetic field and plasma data for the solar wind near the earth. Seven of the events were classified as storm sudden commencements (ssc) and 4 as sudden impulses (si) by most stations reporting them. All of the ssc's were caused by hydromagnetic shocks. Two of the si's were negative impulses and were caused by tangential discontinuities across which the density decreased. The other 2 si's were distinct pulses in the magnetograms and were caused by dense spots in the solar wind with dimensions ≈ .005 AU. There was no consensus among the reporting magnetic observatories as to whether the remaining 8 events should be called si's or ssc's. Five of these events were caused by shocks and the other 3 by tangential discontinuities in the solar wind, but there seems to be no sure way to predict the type of structure from the shape of the magnetogram pulse. The rise time of the impulse in the H component in the magnetogram is apparently determined by something other than the type, the speed, or the thickness of an interplanetary discontinuity which caused the event. Author

N69-17997*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIURNAL AND SEASONAL VARIATION OF ATMOSPHERIC ION COMPOSITION; CORRELATION WITH SOLAR ZENITH ANGLE
H. C. Brinton, R. A. Pickett, and H. A. Taylor, Jr. Oct. 1968 32 p refs
(NASA-TM-X-63443; X-621-68-375) Avail: CFSTI CSCL 04A

A global measurement of the diurnal and seasonal variations of the primary atmospheric ions in the earth's topside ionosphere between 280 and 2700 km has been made using the ion mass spectrometer on Explorer 32. Evidence of direct correlation between solar zenith angle and the low and midlatitude distributions of thermal H^+, He^+, N^+, and O^+ was obtained as the satellite orbit plane traversed one complete diurnal cycle between June 11 and October 5, 1966. The northern midlatitude ionosphere at 1600 km, near the O^+–H^+ transition level, exhibited strong diurnal variation. O^+ rising sharply at dawn to become the dominant daytime ion with a concentration of 1×10^4 ions/cm^3. H^+ was dominant at night with a concentration of 1×10^4 ions/cm^3, a factor of five higher than its daytime value. The diurnal variations of N^+ and He^+ in this region resembled those of O^+ and H^+, respectively, at reduced concentrations. Measurements at 1200 km in the geomagnetic latitude intervals 45° to 55° (summer hemisphere) and −45° to −55° (winter hemisphere) showed a strong seasonal change in the O^+ and N^+ diurnal distributions, but little change in H^+ and He^+. Author

N69-18028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE DIURNAL TIDE WITHIN THE THERMOSPHERE
H. Volland and H. G. Mayr Nov. 1968 41 p refs
(NASA-TM-X-63406; X-621-68-444) Avail: CFSTI CSCL 04A

The atmospheric tide within the thermosphere driven by the solar EUV heat input has a predominant diurnal component, contrary to the tides within the lower atmosphere where the semidiurnal component prevails. Based on this observatorial fact, a

theory of the thermospheric tides is given in which the spherical harmonics of lowest degree are considered as the eigenfunctions of the problem. Perturbation theory is used which leads to a complete separation between a zonal and a diurnal system. A general solution is given and the zonal and the diurnal horizontal wind system at 300 km height is calculated. This wind system has an equatorward directed component at low latitudes during daytime which allows to explain the equatorial F2 anomaly as resulting from an enhancement of electrons at ±10° latitude due to such winds.
Author

N69-18069*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TERRESTRIAL AND SPACE ENVIRONMENT RESEARCH AT MSFC
Margaret Alexander, S. Clark Brown, Dennis W. Camp, Charles C. Dalton, Lee W. Falls et al *In its* Res. Achievements Rev., Vol. 2 1968 87 p refs (See N69-18059 07-34)
Avail: CFSTI CSCL 04

The properties of the longitudinal component of atmospheric turbulence are examined. Data meesurements of the lower atmosphere, obtained from NASA's 150 m meteorological tower located close to Launch Complex 39A at KSC, Florida, are presented. Relationships are shown between mean wind speeds and the standard deviations of wind speed and direction. Information is provided on peak wind speed profiles, gusts, and gust factors. Several statistical concepts in the analysis of a time ordered data sample are presented in terms of wind statistics applicable to aerospace vehicle design and operational problems. Results are presented of six rocket launched probes instrumented to measure neutral molecular nitrogen densities and electron densities and temperature between 140 and 325 km; results are compared with current atmospheric models. Ionospheric disturbances caused by ground based acoustic energy sources are studied. Two alternative formulations for meteor luminous efficiency are used as bases for selecting corresponding subsamples for statistical analysis. The background of Martian atmosphere model development is traced.
B.P.

N69-18108*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUPRATHERMAL ELECTRONS IN THE POLAR IONOSPHERE
E. J. R. Maier Dec. 1968 13 p refs
(NASA-CR-63445; X-615-68-489) Avail: CFSTI CSCL 04A

A retarding potential analyzer onboard Explorer 31 was used to observe energy distributions of suprathermal (5 E 200eV) electrons in the polar ionosphere. Analysis of obtained electron flux data found a rapid decrease of the thermal particle Maxwell–Boltzmann distribution function in the region of interest.
G.G.

N69-18109*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A TWO DIMENSIONAL MODEL OF THE DIURNAL VARIATION OF THE THERMOSPHERE. PART 2: AN EXPLANATION OF THE SECOND HEAT SOURCE
H. Volland, H. G. Mayr, and W. Priester Nov. 1968 42 p refs
(NASA-TM-X-63408; X-621-68-449) Avail: CFSTI CSCL 04A

A two dimensional model of the thermosphere between 120 and 400 km is presented in which solar EUV heat input is the only external heat source taken into account. By choosing the boundary values of the model appropriately, amplitude and phase of the observed diurnal variations of density, temperature and winds are reproduced in a consistent manner. It is concluded that horizontal convection, convective energy coupling between lower atmosphere and thermosphere and heat conductive energy exchange between thermosphere and exosphere are of great significance for the energy and particle balance of the thermosphere. These processes were basically neglected in Harris and Priester's model. Therefore they must be considered to be the origin of the "second heat source".
Author

N69-18128*# Utah Univ., Salt Lake City.
THEORETICAL COMPARISON OF BEADS, WIRES, AND FILMS AS ROCKETSONDE TEMPERATURE SENSORS IN THE MESOSPHERE
Forrest L. Staffanson Washington NASA Feb. 1969 52 p refs
(Grant NGR-45-003-025)
(NASA-CR-1286; UTEC-MR-67-055) Avail: CFSTI CSCL 04A

Parameters are compared for three basic sensor shapes: the small sphere, the thin circular cylinder in cross flow, and the thin flat plate in parallel flow. For quantitative comparisons arbitrary sensor specifications and environmental conditions are chosen. The thickness dimension is as thin as practical for the respective shape. The volume specific heat corresponds to a material commonly used for the respective shape. For uniformity in absorptivity and emissivity each of the three shapes is assumed to have a thin opaque coat of aluminum with solar absorptivity, long wave absorptivity, and emissivity. The air flow and radiation environment is approximately that encountered by a sensor mounted on a stable parachute sonde system having weight and dimension of the ARCAS system and falling in the altitude interval 90 to 50 km. From the theoretical comparison of the thermometric performance of the three basic shapes, it is found that the two dimensional or planar shape appears generally the most promising for future immersion sensor designs. Its principal features are: small recovery factor associated with its larger aerodynamic characteristic length, small thermal mass associated with its thinness, etc.
B.P.

N69-18140*# Hawaii Inst. of Geophysics, Honolulu.
DEVELOPMENT OF A DYNAMIC METHOD FOR DETERMINING THE TERRESTRIAL GRAVITY FIELD FROM SATELLITE DATA Final Report
Mohammad Asadullah Khan 14 Jan. 1969 52 p refs
(Grant NGR-12-001-036)
(NASA-CR-99494; HIG-68-18) Avail: CFSTI CSCL 08N

The method makes use of the Hamiltonian function associated with the satellite motion, which is time-invariant for the degenerate case when all perturbations are ignored but which, under special assumptions, has an integrable time-derivative when the effect of the perturbing forces is considered. Since the potential function of the earth appears additively in the Hamiltonian function, it is possible to set up observation equations which can be solved for the spherical harmonic coefficients of the geopotential which appear linearly in these equations. Since the method is primarily meant to determine the short-wavelength features of the gravity field, the long-wavelength components may be considered known from the previous satellite solutions, and only the coefficients of the higher degree terms may be determined. Such high degree coefficients will describe the gravity field for the area which is immediately below the orbital segments analyzed, since the mass distribution in this area will play a dominant role in perturbing the satellite trajectory over the area.
Author

N69-18179# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 196 14 Jan. 1969 p 41-45 (See N69-18176 07-34) refs
Avail: CFSTI

Aerial oceanographic methods are used to determine surface water temperature distributions and acoustic methods are employed for hydrological underwater studies; the development of a special underwater television camera is reported. Attached abstracts of scientific studies contain mathematical models for analyzing hydrometeorological problems and research in radionuclide sorption on shallow water sediments.
G.G.

N69-18180# Joint Publications Research Service, Washington, D. C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 196 14 Jan. 1969 p 46–72 refs (See N69-18176 07-34)
Avail: CFSTI

Basic principles of geophysical measurements are discussed together with graphic interpretation methods in geodetic engineering. Various abstracted scientific studies on gravimetric sea tests, bottom seismographs, earth structure, geomagnetic effects, etc. are included. G.G.

N69-18204# Dominion Observatory, Ottawa (Ontario).
POLYNOMIAL ESTIMATION OF CERTAIN GEOMAGNETIC QUANTITIES, APPLIED TO A SURVEY OF SCANDINAVIA
G. V. Haines 1968 35 p refs Supported by Govt. of Can., Den., Finland, Norway, and Swed. *Its* Vol. 37, No. 4 p 79-112
Avail: CFSTI

It is mathematically convenient to describe the geomagnetic field over a small portion of the earth's surface in terms of polynomials in a polar stereographic coordinate system. The method is applied to data from an airborne magnetic survey of Norway, Sweden, Finland, and Denmark, conducted in 1965. Polynomials of the third degree were fitted by the method of least squares to the observed values of two orthogonal horizontal components and the vertical component, in three independent analyses. From the three polynomials, values of the north (X), east (Y) and vertical (Z) components, together with their standard errors, were computed at grid points, and are shown as contour charts. Charts of the vertical gradients ($\delta X/\delta z$, $\delta Y/\delta z$, $\delta Z/\delta z$) and the vertical component of curl H, calculated from the polynomials, are also given. By statistical tests, the vertical component of curl H differs significantly from zero in two small regions. Geomagnetic components and vertical gradients calculated from the polynomials are compared with values computed from Cain's spherical harmonic model GSFC (12/66). Finally, charts of the residuals, or differences between the observed field and the polynomial representation of the field, are plotted, both as profiles along the flight paths and as vector diagrams in horizontal and vertical planes. Author

N69-18210# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC OBSERVATIONS Monthly Bulletin, Aug. 1968 [OBSERVATIONS IONOSPHERIQUES Bulletin Mensuel, Aout 1968]
1968 25 p In FRENCH and DUTCH
Avail: CFSTI

Tables of data of ionospheric observations performed at Dourbes (Belgium) in August 1968 are listed giving daily values of critical frequency, maximal usable frequency, minimal frequency permitting reflection, maximum occultation and virtual height of the ordinary wave in E and F regions. Author (ESRO)

N69-18211# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
ELIMINATION OF THE EFFECTS OF PILOTING IN ANALYZING THE ACCELERATIONS INDUCED BY THE ATMOSPHERIC TURBULENCE [SUPPRESSION DES EFFETS DU PILOTAGE LORS DE L'ANALYSE DES ACCELERATIONS INDUITES PAR LA TURBULENCE]
Guy Thomasset 1968 8 p refs In FRENCH; ENGLISH summary Presented at the 6th Intern. Congr. of Aeron. Sci., Munich, 9–13 Sep. 1968 Submitted for publication
(ONERA-TP-603) Avail: CFSTI

A statistical distribution of atmospheric turbulence levels can be obtained immediately from the flight record accelerations of an aircraft after calibrating its energy and frequency transfer. Where these accelerations are partly produced by pilot's maneuvering, the turbulence distribution function is distorted. The suggested method corrects this distortion by an analog suppression of the acceleration produced by maneuvering. It is based on automatic computation of the accelerations induced by the elevator angle, on analog computer simulating the flight behavior of the plane. Rough and corrected accelerations are compared and a new insight is given on the use of commercial flights to measure turbulence on a worldwide scale. Author (ESRO)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-17243# Institut Franco-Allemand de Recherches, St. Louis (France).
A DOPPLER EFFECT DIFFERENTIAL METHOD FOR MEASURING VELOCITY [EIN DOPPLERDIFFERENZVERFAHREN ZUR GESCHWINDIGKEITSMESSUNG]
H. J. Pfeifer and H. D. vom Stein 29 Mar. 1967 12 p refs In GERMAN
(Contract T-659-I-206)
(ISL-T-12/67) Avail: CFSTI

Described is a Doppler method utilizing lasers and optical detectors for high velocity ballistic measurements. This system superimposes two coherent partial scans after reflection from the moving object on a photodetector so that the difference between the Doppler frequency of both scans is projected. Experimental results show that this difference is proportional to the velocity. Transl. by G.G.

N69-17259*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AN ANALYTICAL PROCEDURE FOR OPTIMIZING TELEVISION SYSTEMS FOR PLANETARY DESCENT MISSIONS
Friedrich O. Huck Washington Feb. 1969 28 p refs
(NASA-TN-D-5061) Avail: CFSTI CSCL 17B

An analytical procedure is developed for optimizing spacecraft television systems to secure proper overlap between successive pictures and maximum surface resolution during planetary descent. The television characteristics of concern are optical field of view and number of scan lines. Results show how the optimum combination of these characteristics depends on target brightness, camera sensitivity, transmission rate, and spacecraft trajectory values. Author

N69-17331# Institut Franco-Allemand de Recherches, St. Louis (France).
ON RESOLUTION POWER AND MEASUREMENT PRECISION OF BALLISTIC CAMERA WITH ROTATING PRISM AT ISL [UEBER DAS AUFLOESUNGS VERMOEGEN UND DIE MESSGENAUIGKEIT DER IM ISL ENTWICKELTEN BALLISTISCHEN MESSKAMERA MIT DREHPRISMA]
J. Biele 2 Aug. 1967 36 p refs In GERMAN
(ISL-T-5/67) Avail: CFSTI

The effects of a rotating prism on the optical image quality of a ballistic camera are studied. Calculated values for image field curvature, relative error ratio of the lens aperture, and astigmatism are used to predict the resolving power of the camera and to determine the requirements for measuring moving as well as still object points. Example measurements under static conditions on a star shape find an optical resolution of about 175 lines per mm at image center with a 40% decrease at image boundaries. Only minor inaccuracies are observed with moving prism and moving films. Transl. by G.G.

N69-17452# Los Alamos Scientific Lab., N. Mex.
LIGHT METER FOR P-16 PHOSPHOR CATHODE-RAY TUBES
Wilbur K. Brown 18 Oct. 1968 4 p refs
(Contract W-7405-ENG-36)
(LA-3975-MS) Avail: CFSTI

A light meter is described that has been developed for setting the intensity of P-16 phosphor cathode-ray tubes. The light meter is used in the recording of time-of-flight neutron cross-section data in measurements using an underground nuclear explosion source. Author (NSA)

N69-17470# California State Div. of Highways. Materials and Research Dept.
EVALUATION OF THE PORTABLE BOREHOLE DEFLECTOMETER Interim Report
Travis Smith 18 Apr. 1968 12 p ref Supported in part by Bur. of Public Roads
(M/R-632722-1; PB-180128) Avail: CFSTI CSCL 13M

The Borehole Deflectometer was evaluated to determine its usefulness as a research instrument. USGRDR

N69-17473# Western Ontario Univ., London. Dept. of Physics
REFRACTOMETER ADSORPTION IN TRANSIENTS AND AT SUB-FREEZING TEMPERATURES Final Report, 1 Nov. 1963-31 May 1968
Donald R. Hay Jun. 1968 108 p refs
(Contract AF 19(628)-3835)
(AD-679998; TP-4; AFCRL-68-0413) Avail: CFSI CSCL 4/1

This work extends the investigation of the refractometer response to humid air in four directions. The observed magnitude of adsorption error in the h-f refractometer at temperatures down to -23C remains large for relative humidities above 90 percent, increasing to 150 N-units as humidity approaches saturation; no adsorption error is found in the dual-cavity refractometer at temperatures -13C for humidities up to 85 percent, but further work must be preceded by a study of the stability of the refractometer calibration. The magnitude of smoothness of the surface and absence of chemical contamination are important factors in reducing adsorption effects. The response of the h-f refractometer to a transient in air refractivity depends upon the speed of the sensor through the transient and upon the air humidity: at low humidities the refractometer responds faithfully to the transient, but at high humidities, the indicated amplitude decreases with increasing speed of the sensor; recovery of the instrument after passage through the transient is extended with increasing exposure time in the jet and with increasing jet humidity. The thermal lag of the h-f refractometer is complicated by the instrument geometry; a detailed analysis of this property of the instrument is recommended. Author (TAB)

N69-17509# Chicago Univ., Ill. Dept. of Physics.
SIMPLE SCANNING ELECTRON MICROSCOPE
A. V. Crewe, M. Isaacson, and D. Johnson [1968] 25 p refs Supported in part by AEC
(EFINS-68-73; COO-1721-6) Avail: CFSTI

A simple scanning microscope has been built which uses a field emission electron gun alone, without the aid of auxiliary lenses. The design and operation of the microscope are described and the calculated performance is compared with experiment. Resolution of 100 Å has been obtained and is shown in transmission electron micrographs. The probe current is of the order of 10^{-10} to 10^{-11} A, a value which is high enough to allow micrographs to be taken with scan times of 10 seconds. Author (NSA)

N69-17529# Los Alamos Scientific Lab., N. Mex.
TESTS OF SIX HIGH TEMPERATURE NEUTRON DETECTORS TO 650°C
J. L. Bacastow and E. O. Swickard 20 Jun. 1968 6 p Presented at the 15th Nucl. Sci. Symp., Montreal
(Contract W-7405-ENG-36)
(LA-DC-9611; CONF-681017-1) Avail: CFSTI

Two neutron detectors (fission counters) from each of three manufacturers were tested at several temperatures between ambient and 650°C. Parameters examined as a function of temperature were: pulse height distribution, noise vs. voltage, capacitance, and leakage current. Author (NSA)

N69-17547# United Kingdom Atomic Energy Authority Springfields (England).
THE DESIGN AND CONSTRUCTION OF ACOUSTIC TRANSDUCERS FOR USE IN AGR SIMULATION LOOPS
J. Rooney 26 Feb. 1968 18 p refs
(TRG-1650(S)) Avail: CFSTI; UK 5s

The design, construction, and calibration of acoustic transducers for use in out-of-pile testing of fuel elements are described. Some work on acoustic transducers for high-temperature operation above 250°C is discussed. Author (NSA)

N69-17601# United Kingdom Atomic Energy Authority, Harwell (England).
THE DERIVATION OF A TRITON ENERGY RESPONSE FUNCTION FOR Li^6 SEMICONDUCTOR SANDWICH SPECTROMETERS
M. G. Silk Jun. 1968 19 p refs
(AERE-M-2009) Avail: CFSTI; UK 3s 6d

A calculation of the triton energy response function is described in which the geometry of lithium-6 semiconductor sandwich spectrometers of the surface-target type is taken fully into account. The calculations assume an isotropic fast neutron flux, but this is not considered a serious limitation for reactor studies. The effects of the uncertainty in the present values for the differential cross-section of the $^6Li(n,t)^4He$ reaction are also considered, and it is concluded that the full potential of this technique for determining fast neutron spectra cannot be realized until these discrepancies are resolved. At present systematic errors of up to 20% may occur in the lower-energy ranges. Author (NSA)

N69-17607# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
NONCONTACT HEAD DEVELOPMENT Final Report, Jan. 1966-Jul. 1968
A. R. Lowe 6 Dec. 1968 27 p refs
(Contract Nonr-3815(00))
(AD-679623; RR-68-27) Avail: CFSTI CSCL 14/3

Additional wear tests were conducted, and signal-to-noise ratio versus wear information synthesized. A search was made unsuccessfully for scrape flutter components in the equipment. TAB

N69-17609# Rensselaer Polytechnic Inst., Troy, N. Y. Div. of Electrophysics.
A STUDY OF THE RIBLET COUPLER (FOR RECEPTION OF TE(o)01 MODE ENERGY BY A VEHICLE IN A TUBE)
John A. Bradshaw Jan. 1968 24 p refs
(Contract C-117-68; Proj. Tubeflight)
(TR-EP-6802; PB-180278) Avail: CFSTI CSCL 13F

The operation of the Riblet coupler in multi-mode round waveguide is described analytically, for the case where three TE (o) 01 modes propagate in the coupling gap. A model of the coupling structure, for a vehicle flying in a tube, was built and tested, using this Riblet coupling as a basis. The coupler collected 96% of the power incident on the vehicle; however, the gap length and centering of the vehicle were more critical than expected. Details of the model and measurements are given, as well as a method for subdividing the power collected into packages suitable for rectification. Author (USGRDR)

N69-17625# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANNULAR RADIOTELESCOPE WITH HIGH RESOLVING POWER
G. M. Tovmasyan 1 Feb. 1968 9 p refs Transl. into ENGLISH from Soobshch. Byurakansk. Observ. Akad. Nauk Arm. SSR (Erevan), no. 36, 1964 p 79–85
(AD-679801; FTD-HT-23-1136-67) Avail: CFSTI CSCL 9/5

A new radio telescope system is described. This system consists of two annular mirror telescopes with very high effective resolving power. The main mirror is a narrow spherical ring of large diameter. The normal to the ring forms a small angle with the horizon. The ring consists of individual elements. The second mirror is moved on the focal line of the main mirror, and has a diameter equal to half that of the main mirror. TAB

N69-17636# Air Force Cambridge Research Labs., Bedford, Mass.
FACTORS AFFECTING THE APT PICTURE QUALITY
Robert F. Myers Oct. 1968 29 p *Its* Instrumentation Paper No. 149
(AD-679532; AFCRL-68-0517) Avail: CFSTI CSCL 4/2

The Muirhead K-300A Recorder operation is analyzed and a daily quality control routine is suggested which permits evaluation of the photographic process, the light source, and the electronic function generator separately. An objective technique for optimizing the image density range for a given weather satellite is presented, using the daily quality control data generated by recording a signal sequence and a densitometer measurement of the reflective density of the image. Author (TAB)

N69-17702*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
DYNAMIC CALIBRATION OF TURBINE FLOWMETERS BY MEANS OF FREQUENCY RESPONSE TESTS
Grady H. Stevens Washington Feb. 1969 15 p refs
(NASA-TM-X-1736) Avail: CFSTI CSCL 14B

A technique for dynamic calibration of turbine flowmeters for small-amplitude sinusoidal perturbations was investigated. The investigation included a theoretical analysis and an experimental evaluation of a typical flowmeter for a range of frequencies and mean flow rates. The indicated flow was related to the actual flow by a first-order lag function. This lag function was completely defined by a breakpoint frequency which was directly proportional to mean flow rate. The proportional constant was determined experimentally for a typical flowmeter. This calibration constant was sufficient for completely specifying the flowmeter dynamics over the range of mean flows investigated. Author

N69-17904# Institut Franco-Allemand de Recherches, St. Louis (France).
MULTI-CANAL, MONO-IMPULSE PRODUCER [MEHRKANAL-MONOIMPULSGEBER]
R. Pieth 4 Aug. 1967 3 p In GERMAN
(ISL-N-12/67) Avail: CFSTI

Described is the performance of a multiple channel single impulse transmitter for oscillographic time interval measurements between several impulses arriving simultaneously in different channels. This single impulse receiver transmits the first impulse arriving in each channel and suppresses consecutive noise signals. All admitted impulses to the oscillograph are of equal duration but of different amplitudes for distribution into the corresponding channels. Delay times between incoming and outgoing signals are about 50 ns. A block diagram for a four channel receiver-transmitter is included. Transl. by G.G.

N69-17917# Institut Franco-Allemand de Recherches, St. Louis (France).
XENON SPARKS FOR SILHOUETTE PHOTOGRAPHY OF PROJECTILES [XENONFUNKEN FUER SCHATTENBILD-AUFNAHMEN VON GESCHOSSEN]
M. Starke 24 Jul. 1967 9 p ref In GERMAN
(ISL-N-9/67) Avail: CFSTI

A xenon spark gap with a distance of 1.5 mm between electrodes was used to produce luminescent light point sources for shadow photography. The gas pressure of the spark gap was adjusted for a static discharge at 7 to 8 kV and the discharge energy at a voltage charge of U = 10 kV with charge condensator C = 50 nF was: $E = 1/2\ CU^2 = 2.5$Ws. Author

N69-17940# Los Alamos Scientific Lab., N. Mex.
MODEL-10 PRECISION DELAY TRIGGER GENERATOR
A. T. Brousseau 30 Oct. 1968 10 p
(Contract W-7405-ENG-36)
(LA-3964-MS) Avail: CFSTI

The model-10 precision delay trigger generator, which, together with its precursor models, has been used extensively throughout the Los Alamos Sherwood Project for the last ten years is described. The intent is to provide the user with an operating instructional manual. Author (NSA)

N69-17944*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
REQUIREMENTS OF MARTIAN TELEVISION EXPERIMENT FOR THREE POINT-MASS DESCENT TRAJECTORIES
Friedrich O. Huck, Leonard P. Kopia, and Robert B. Spiers, Jr. Washington Feb. 1969 37 p refs
(NASA-TN-D-5062) Avail: CFSTI CSCL 17B

An analytical approach is used to specify the transmission rate and field-of-view requirements of a television experiment on board a spacecraft as it descends through the Martian atmosphere to land a surface laboratory. The objectives of this experiment are to provide a chain of overlapping images between orbiter and surface-laboratory pictures and a 1-meter-resolution survey of the landing site before impact. Preliminary estimates of the requirements and prediction of the performance are based on three point-mass trajectories, which are the result of numerical integrations of the spacecraft motion through two different Martian atmospheric models. It is found that a single television system can achieve the experiment objectives. For a 200-line television system, the required transmission rates range from 1.4 ± 10^5 to 2.7 ± 10^5 bits per second, and the fields of view range from 12° to 22°, depending on the descent trajectory and the camera viewing direction. This required transmission rate may be halved by employing two television systems. Author

N69-17998*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
A GAMMA RAY TELESCOPE UTILIZING LARGE AREA WIRE SPARK CHAMBERS
R. W. Ross, C. H. Ehrmann, C. E. Fichtel, D. A. Kniffen, and H. B. Oegelman Nov. 1968 13 p refs
(NASA-TM-X-63416; X-611-68-443) Avail: CFSTI CSCL 17H

A second generation gamma-ray telescope has been developed for further experiments in balloon-borne astronomy. This instrument is composed of 32 wire-grid spark chamber modules, each 50 × 50 cm^2, utilizing two-coordinate ferrite core readout. The detector is flown on a 27 million cubic foot research balloon in a search for discrete gamma-ray sources and supernovae explosions. Author

N69-18071*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
INSTRUMENTATION RESEARCH FOR GROUND TESTING AT MSFC
Thomas L. Greenwood, Harlan S. Harman, Helmut G. Lackner, Alvin M. Payne, and Albert E. Schuler *In its* Res. Achievements Rev., Vol. 2 1968 43 p refs (See N69-18059 07-34)
Avail: CFSTI CSCL 14B

An accurate slush density reference system and two different transfer standards were developed for making reliable field measurements of the mass of slush hydrogen after calibration with

the reference system. The design, development, and fabrication of the following instruments are discussed: (1) an experimental high temperature, high frequency response pressure transducer for combustion instability studies requiring frequency response of 20 kHz in an environment where temperature reaches 4144°K and the heat flux can be as high as 8200 W/cm^2; and (2) a cryogenic pressure transducer for static and dynamic measurements at liquid helium temperatures. The Mossbauer effect and laser interferometry were used to determine extremely small amplitudes for vibration measurements and calibrations. A new tool was developed for accurate dc amplification and digital data transmission. B.P.

N69-18103# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany).
INVESTIGATION OF AN OSCILLOGRAPHIC MEASURING METHOD FOR HIGH PULSED VOLTAGE OF A FEW NANOSECONDS [UEBER DIE OSZILLOGRAFISCHE MESSUNG VON HOCHSPANNUNGSIMPULSEN IM NANOSEKUNDENBEREICH]
M. Pillsticker Jun. 1968 40 p refs In GERMAN
(BMwF-FBK-68-27) Avail: CFSTI

Investigations on the measurement of pulsed high voltage up to 100 kV and a few nanoseconds are reviewed. Such measurements are accomplished with a voltage divider and a cathode ray oscilloscope, connected with a coaxial cable. Relations of a cylindrical shielded low resistance divider are discussed. The transmitting conditions of the divider, cable and oscilloscope are calculated and measured. Author (NSA)

N69-18121# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Advanced Development Program.
PROJECT KANGAROO: A POTENTIAL ANTI-SUBMARINE AND OCEANOGRAPHIC SYSTEM
Fred A. Wohliebe Oct. 1968 271 p refs
(FSR-AD3-02-68.3) Avail: CFSTI

Details are given on the analysis, design and testing of a concept which enables fixed-wing aircraft to tow a probe for anti-submarine or oceanographic purposes. The probe, which trails behind the aircraft on the end of a long cable, does not remain submerged, but enters and leaves the water in a stable cyclic manner. Design considerations leading to the development of a full scale system are discussed in detail. A flight test program was initiated to verify the mechanical concept and provide information on trajectory parameters. Test results compare favorably with predicted values. Author

N69-18133*# Texas Univ., Austin. Electrical Engineering Research Lab.
CALIBRATION PROGRAM FOR THE 16-FOOT ANTENNA Technical Report, 1967–1968
J. R. Cogdell 15 Jan. 1969 64 p refs
(Grant NGL-44-012-006)
(NASA-CR-99330; NGL-006-69-1) Avail: CFSTI CSCL 17H

The report is concerned with the calibration of a 16-foot-diameter parabolic reflector of high precision, the primary component in a radio telescope at the Millimeter Wave Observatory, Mt. Locke, Texas. Absolute gain and pattern of the antenna were tested at three frequencies of operation: 35 GHz, 70 GHz, and 97 GHz. Some work which is part of a stability study of the antenna at 35 GHz is described. Antenna pointing accuracy and site are also evaluated. Three receivers were used in the measurements, all of which were of the same general type, differing only in the frequency of operation. K.W.

N69-18201*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid, Thermal and Aerospace Sciences.
MEASUREMENT OF TURBULENCE QUANTITIES BY PRESSURE PROBES
Yasuniro Kamotani and H. Kenneth Wiskind Sep. 1968 61 p refs
(GRANT NGR-36-003-064)
(NASA-CR-99336; FTAS/TR-68-33) Avail: CFSTI CSCL 14B

The pressure probe was developed by Jezdinsky, as an instrument to measure turbulence intensities and shear stress. His original equation, on which the pressure probe is based, is erroneous and is derived here in a more rigorous manner. The value of turbulent shear stress computed from Jezdinsky's equation is found to be too small. The pressure probe method necessitates measuring the mean velocity and the static pressure by other instruments. In the present discussion the mean total and static pressures in a turbulent flow are measured by a Pitot tube. The pressure probe is tested by measuring turbulence quantities in a round free jet, and the results are compared with those taken by a hot-wire anemometer. The agreement is satisfactory. Author

N69-18207# Centre National d'Etudes Spatiales, Brétigny-sur-Orge (France).
TAPE RECORDERS FOR GROUND BASED STORAGE OF TELEMETRY DATA [LES ENREGISTREURS-LECTEURS MAGNETIQUES UTILISES POUR LE STOCKAGE AU SOL DES TELEMESURES BRUTES]
J. C. Courteille Mar. 1968 82 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–Apr. 1968
Avail: CFSTI

Instruments and their operation modes are described. The recording of PCM signals is analyzed and WOW and flutter as well as time displacement errors are discussed. The characteristics of magnetic tapes are given and broad-band recording is discussed. ESRO

N69-18244# Société Industrielle des Nouvelles Techniques Radioelectriques, Asnieres (France). Dept. Projets et Systèmes.
SOLAR SENSITIVE PERISCOPE: PSP-50 [POINTEUR SOLAIRE PERISCOPE: PSP-50]
15 Mar. 1968 37 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

The SINTRA PSP-50 periscope which provides light for experiments on the axis of a rocket is fully described. A two-mirror system, with variable elevation and azimuth is used to conduct sunlight to the region to be illuminated. ESRO

N69-18255# European Space Technology Center, Noordwijk (Netherlands).
MAGNETIC TESTING OF THE HEOS-A1 PROTOTYPE
O. G. Feil Paris ESRO May 1968 32 p refs
(ESRO-TN-30(ESTEC)) Avail: CFSTI

This paper describes tests on the prototype of the ESRO satellite HEOS-A1 (Highly Eccentric Orbiting Satellite). The tests were carried out in the ESTEC magnetic test laboratory to determine if the spacecraft meets the specifications regarding magnetic cleanliness. After a brief outline of the test facilities used, the test sequence and procedures are given, followed by a tabulation of the results obtained. An analysis of the errors occurring in the measurements is included. The main conclusion to be drawn from the results is that the spacecraft has a high degree of magnetic cleanliness. By proper demagnetisation, field values below 0.5 gammas (0.5×10^{-5} gauss) at the location of the flight magnetometer sensor can be achieved. Author (ESRO)

N69-18296# National Center for Atmospheric Research, Boulder, Colo.
AN OPTICAL-ELECTRICAL PARTICLE SIZE DISCRIMINATOR
Robert G. Knollenberg 2 Apr. 1968 22 p
(GRANT NSF C-480)
(PB-179645) Avail: CFSTI CSCL 04A

The invention is an optical-electrical device for measuring the size and number of all types of particulate matter and objects. Two complete particle size measuring systems have been constructed using this novel idea. One of these is a prototype unit useful in testing and calibration, and the second utilizes an aircraft installation to measure the size of water drops and ice crystals in the atmosphere. The aircraft system has been used in studies of weather modification. USGRDR

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-17254# Mechanical Technology, Inc., Latham, N. Y.
EXPERIMENTAL STUDY OF AN EXTERNALLY PRESSURIZED, STEAM LUBRICATED, SINGLE RESTRICTOR, CIRCULAR THRUST BEARING Topical Report No. 3
F. K. Orcutt and S. B. Malanoski Aug. 1968 79 p
(Contract AT(30-1)-3839)
(MTI-68-TR-35; NYO-3839-3) Avail: CFSTI

Results of an experimental study to develop a practical steam-lubricated thrust bearing are reported. Instruments used to measure experimental variables are described, theories for externally pressurized bearings are developed, rotor surface temperature and film pressure measurements are tabulated, and the effect of steam hammer instability is discussed. NSA

N69-17260 California Univ., Berkeley.
THE DETECTION AND DIAGNOSIS OF MALFUNCTIONS IN ENERGY MANIPULATING SYSTEMS
Robert Lee Osborne (Ph.D. Thesis) 1967 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-10388

A method is presented for choosing measured variables and generating algorithms which will detect and diagnose system malfunctions to the correct subsystem or environmental cause. The method is applicable to lumped parameter, energy manipulating systems which include linear and a large class of nonlinear systems. Malfunctions involving system structure changes are allowed. On-line operation is assumed. No assumptions relative to system excitation are made. An indication of system condition is made at each data sample time. Intermittent malfunctions in memory systems are treated. For cases where there is additive noise on the measured variables, a method of nonlinear filtering is presented. The complete method is applied to a multiple tank hydraulic system simulated on a digital computer. Dissert. Abstr.

N69-17278 California Univ., Berkeley.
A DIE PROFILE FOR INCREASED EFFICIENCY IN AXISYMMETRIC COLD EXTRUSION
Henry Curtis Sortais (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-10445

In reducing the diameter of a bar, composed of a rigid perfectly plastic material obeying the von Mises yield condition by extrusion, redundant work of deformation is necessary for shearing. Redundant work is defined as the extra work required beyond the minimum (optimum) value of work, assuming negligible die friction. The axisymmetric die profile for increased efficiency is defined here as the curved die profile which eliminates theoretically the redundant work of deformation due to shearing. Theoretical results achieved for a common area reduction (4:1), indicate that for a specific curved profile, the efficiency is approximately one percent less than the optimum efficiency. Comparison of the redundant work of deformation achieved experimentally, using a non-work-hardenable material (commercially pure lead) as a model for the rigid perfectly plastic material, was made with the theoretical value for the curved die. Dissert. Abstr.

N69-17387# Mechanical Technology, Inc., Latham, N. Y.
DESIGN OF AN EXPERIMENTAL STEAM-LUBRICATED ROTOR-BEARING SYSTEM
F. K. Orcutt S. B. Malanoski, and K. L. Streifert Sep. 1968 65 p refs
(Contract AT(30-1)-3839)
(MTI-68-TR-43; NYO-3839-4) Avail: CFSTI

The design, construction, and experimental operation of a multi-bearing rotor system wherein the rotor is supported entirely by steam-lubricated bearings is described. The system consists of the rotor with two externally-pressurized steam-lubricated journal bearings and one thrust bearing which is also steam-lubricated and externally-pressurized to support and position the rotor. Systems are described to generate, control, and process the steam lubricant; drive and rotate the shaft at speeds from several hundred to 7500 rpm; apply steady state radial and dynamic loads to the rotor; control heat loss from the rotor and bearing housing; and an instrumentation system to permit control of the operating and environmental variables and to measure performance of the bearing rotor system. Design parameters for the experimental journal and thrust bearings are given. NSA

N69-17562# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDROSTATIC BEARINGS IN SODIUM PUMPS
N. N. Aristarkhov et al 28 May 1968 20 p refs Transl. into ENGLISH from Zhidkiye Metally. Sb. Statey (USSR), 1967 p 390-402
(AD-679796; FTD-MT-24-75-68) Avail: CFSTI CSCL 13/11

The paper deals principally with slot-type hydrostatic bearings because the throttle-type give negative results. The hydrostatic bearing studied was mounted on a pump rotated by a 36-kW electric motor. Behavior of the bearing was studied in four stages from 300 to 550C: stage I, starting regime; stage II, cyclic starts and stops; stage III, bearing operation when the shaft is rotating at a third of rated rpm; and stage IV, operation with sodium at a temperature of 530-550C to determine resistance of working couples of the bearing. These are to be regarded as qualitative since the opening of the bearing for inspection could have had a negative effect on wear. Supplementary studies are required for a final evaluation of the nature of wear in the working couples. It may, however, be concluded that the hydrostatic slot-bearings operate satisfactorily in sodium pumps. A combination of the friction couples studied may be used in hydrostatic bearings for operation in liquid sodium up to 400C. TAB

N69-17581# Pacific Missile Range, Point Mugu, Calif.
ANTICORROSION SEALING CAPS FOR MECHANICAL FASTENERS
W. L. Mackie Sep. 1968 21 p ref
(AD-679697; PMR-TM-68-4) Avail: CFSTI 13/8

The report discusses the development and testing of a device that prevents or at least inhibits corrosion in fastened metal joints, and presents test results. The device consists of a cup-shaped receptacle, partially filled with a sealant, and is dimensioned to fit over bolt or screw heads. When applied over these fasteners, the device excludes moisture and effectively retards corrosion. Author (TAB)

N69-17829# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VIBRATION-PROOF SLIDE BEARINGS

E. L. Poznyak. 4 Apr. 1968. 22 p. refs. Transl. into ENGLISH from the book "Dinamika Mashin. Sbornik Statey" Moscow, Izd. Mashinostr., 1966 p. 353–367
(AD-679685; FTD-HT-23-1502-67) Avail: CFSTI CSCL 13/9

This paper presents a theoretical analysis of the properties of vibration-proof noncircular bearings, as applied to vibration-proof bearings with fixed working surfaces. It is assumed that the bearings have infinite length. Author (TAB)

N69-17973# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT WHICH VISCOSITY, TEMPERATURE AND PHYSICOCHEMICAL NATURE OF SOLVENT HAVE ON THE OPERATING EFFECTIVENESS OF SURFACE ACTIVE AGENTS DURING ULTRASONIC MACHINING OF METALS
V. I. Likhtman et al. 25 Apr. 1968. 16 p. refs. Transl. into ENGLISH from Uch. Zap. Gos. Ped. Inst. (Orel), v. 33, no. 1, 1966 p. 11–20
(AD-679683; FTD-MT-24-93-68) Avail: CFSTI CSCL 13/8

The effect of solvent properties on the operation of surface-active agents was studied by using inactive liquids--benzene and mineral oil, and solutions of various concentrations of oleic, capric and other acids in benzene and mineral oil. It was found that when concentrations are small, the effects of surface-active agents on the productivity and specific energy of ultrasonic machining of metals are weaker in mineral oil than in the case of the corresponding solutions of these agents in benzene. At concentrations higher than 8%, the productivity and specific energy during machining in benzene and mineral oil with the same surface-active agents are practically identical. Author (TAB)

N69-17988*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
INTRODUCTION TO COMPUTER AIDED RELIABILITY DATA ANALYSIS
Charles R. Toye. Washington, Feb. 1969. 80 p. refs
(NASA-TN-D-5009) Avail: CFSTI CSCL 14D

This report describes the significant features required for the collection, coding, and documentation of hi-rel test data. It also contains a user's manual for the CARDA program, a third-generation computer program designed to fulfill the data reduction, analysis, and presentation requirements found in high reliability component specifications. Author

N69-18043*# Oklahoma State Univ., Stillwater. Fluid Power Controls Lab.
STUDY OF FILTRATION MECHANICS AND SAMPLING TECHNIQUES. Annual Technical Summary Report, Phase 4, 1967–1968
E. C. Fitch, R. E. Reed, and D. E. Long. Jul. 1968. 114 p. refs
(Contract NAS8-11009)
(NASA-CR-98300) Avail: CFSTI CSCL 13K

The specific areas of study which were pursued during the current contract period were the following: (1) The establishment of a physically meaningful cleanliness level criteria for fluids which expresses in quantitative terms the contamination level. (2) The filtration characteristics of filter media as exemplified by their effect on contamination levels. (3) Expressions for the contaminant tolerance level of components in terms of a rigorous cleanliness level criteria. (4) The performance and specification of depth type filter media as they are related to the physical parameters of the matrix. Author

N69-18064*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
QUALITY AND RELIABILITY ASSURANCE RESEARCH AT MSFC
James B. Beal, Robert L. Brown, Leon C. Hamiter, Jr., and Frederic E. Wells. *In its* Res. Achievements Rev., Vol. 2, 1968. 32 p. refs. (See N69-18059 07-34)
Avail: CFSTI CSCL 13H

The emission of infrared radiation by semiconductor chips led to a method for testing microminiature circuits with an infrared microscope. Descriptions on infrared radiation, and composition and operation of the microscope are presented. The feasibility of inspection of the elements and circuit junctions of microelectronic chips is demonstrated. The hydrostatic proof testing of tanks to their full flight loads by the use of slurries is discussed. Guidelines for necessary slurry characteristics are established. Tests were conducted for slurry viscosity under shear stresses, for exposure to sunlight, for compatibility with two cryogenic liquids, and for corrosion on various tank surface materials. The advantages of ultrasonic testing compared with previous nondestructive test methods are discussed. The capabilities of an acoustic spectrometer are demonstrated in a practical test on a section of S-IC fuel tank. The strength of bonded materials was evaluated using ultrasonic emission detector methods. B.P.

N69-18070*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MANUFACTURING ENGINEERING RESEARCH AT MSFC
Robert T. van Aller, Frederick J. Beyerle, Charles R. Cooper, Robert V. Hoppes, Ronald L. Nichols et al. *In its* Res. Achievements Rev., Vol. 2, 1968. 81 p. refs. (See N69-18059 07-34)
Avail: CFSTI CSCL 13H

To bridge the gap between theory and practice in the field of contamination control, the MSFC embarked upon a program to develop methods to clean both intricate and large spacecraft parts to the levels required by NASA specifications. A closed circuit television signal furnished data to permit the development of an automatic guidance system for welding. For system reliability, digital counting and logic techniques are used throughout the control circuitry. Mechanical simulator development conducted in support of the Apollo Applications Program and in anticipation of future programs is summarized. Results are reported on investigations of air bearing systems, air bearing cart thrust systems, and devices for supporting hand tools and the serpentuator. The use of the continuous wave laser and pulsed laser in welding, cutting, and hole punching operations is briefly summarized. The neutral buoyancy facility and equipment at MSFC is described. Aluminum welding procedures and applications to the Saturn 5 vehicle are surveyed. Experimental electron beam welding in space is discussed. B.P.

N69-18145*# Oak Ridge National Lab., Tenn. Reactor Div.
COMPARISON OF BOILER FEED PUMPS FOR CESIUM AND POTASSIUM RANKINE CYCLE SYSTEMS
H. C. Young, D. L. Clark, and A. G. Grindell. Sep. 1968. 73 p. refs
(NASA Order W-12353; Contract W-7405-eng-26)
(NASA-CR-73949; ORNL-TM-2086) Avail: CFSTI CSCL 13K

A study was made of the electromagnetic pump and the electric motor driven (canned rotor) and free turbine driven centrifugal pumps for the boiler feed duty in Rankine cycle systems having an output of 300 kW(e) with cesium or potassium as the working fluid. The polyphase helical induction pump was chosen to represent the electromagnetic pumps. The weight of the basic pump and the increase in weight of the Rankine cycle system (weight penalty) required to supply pump power and control requirements were estimated for each pump. A discussion is presented of some of the unique problems and design considerations associated with each pump such as start-up, control, bearing materials, and auxiliary equipment. Design precepts and preliminary design data for each of the pumps are presented. Author (NSA)

N69-18170 National Lending Library for Science and Technology, Boston Spa (England).
EXPLOSION-PROOF FRICTION BRAKES [EXPLOSIONSGESCHUETZTE REIBUNGSBREMSON]

H. Wintrich et al Aug. 1968 15 p refs Transl. into ENGLISH from Physik.-Tech. Bundesanstalt Mitt. (Brunswick), v. 78, no. 2, Apr. 1968 p 95-100
(NLL-SMRE-Trans-5636-(8313.6)) Avail: Natl. Lending Library, Boston SPA, Engl.

The use of friction brakes in hazardous areas requires special protection against ignition by sparks or running hot. In hazardous areas Division 2, open brakes shall have brake lining of plastic and must be so constructed that the described temperatures are not exceeded. In hazardous areas Division 1, only brakes in flameproof enclosures or forced ventilation enclosures shall be driven, because it is not possible to avoid sufficiently ignition hazards at open brakes in case of breakdown. Author

N69-18261# Naval Research Lab., Washington, D.C. Chemistry Div.
A PRESERVATIVE-LUBRICANT FOR SMALL ARMS
H. R. Baker, R. N. Bolster, and V. G. Fitzsimmons *In its* Rept. of NRL Progr. Dec. 1968 p 8-31 refs (See N69-18258 07-34)
Avail: CFSTI

A preservative-lubricant composition was developed from an amine acid compound, and it provides excellent protection against corrosion to small arms that are exposed to water environments. The protective coating is readily applied from aerosol containers, does not interfere with the normal handling and operation of weapons, provides lubrication, and is compatible with other lubricants. Coatings of this type offer promise as preservatives for exposed parts of operating machinery, spare parts, and tools in other applications where lubricant compatibility or operation without preservation is desirable. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-17364# Sandia Corp., Albuquerque, N. Mex.
LASER LIGHT DETECTING AND RANGING (LIDAR) SYSTEMS GB-60A AND GB-60B
M. J. Landry and J. R. Lochner Sep. 1968 132 p refs
(SC-DR-67-850) Avail: CFSTI

Sandia Laboratories has developed a laser light detecting and ranging (LIDAR) system, primarily for use in tracking and diagnosing clouds formed by the ablation of simulated SNAP heat source materials during atmospheric reentry tests. This report briefly describes the GB-60A, a first generation LIDAR, and describes in detail the GB-60B LIDAR which provides more real time tracking than does the GB-60A. Author (NSA)

N69-17402 Michigan Univ., Ann Arbor.
RAYLEIGH SCATTERING OF RUBY LASER LIGHT IN NEUTRAL GASES
Ralph Ray Rudder (Ph.D. Thesis) 1967 139 p
Avail: Univ. Microfilms: HC 6.60/Microfilm $3.00 Order No. 68-7713

Measurements are described of Rayleigh scattering from atoms and molecules in the gaseous state at one atmosphere. The use of a Q-switched ruby laser of 8 MW average power and care in minimizing spurious light permitted the determination of very small depolarizations. In agreement with theoretical predictions, the depolarization ratio ρ_v (for linearly polarized light) for argon was found to be vanishingly small ($\rho_v \leq 4.10^{-5}$). Similarly, for helium, $\rho_v \leq 3.10^{-3}$. However, xenon and methane exhibited nonzero depolarization ratios: 1.55 (± .25) × 10^{-4} and 1.27 (± .23) × 10^{-4}, respectively. It is found that departures from ideal gas behavior provide the most plausible explanation for these findings. Calculations from currently available theory are presented to support this assertion. The effect of nuclear spin in xenon-129 is considered and shown to contribute negligibly to the measured depolarization. Depolarization ratios were also measured in hydrogen, deuterium, nitrogen, and nitrous oxide, and found to be lower than generally accepted values. Dissert. Abstr.

N69-17520# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OBSERVING AND PHOTOGRAPHING OBJECTS AT A LOCALITY WHILE ILLUMINATING THEM WITH A LASER BEAM
V. M. Arpishkin et al 9 Feb. 1968 8 p refs Transl. into ENGLISH from Optiko-Mekh. Prom. (Leningrad), no. 9, 1967 p 1-3
(AD-679815; FTD-HT-23-1631-67) Avail: CFSTI CSCL 20/5

The use of lasers in an instrument for observing and photographing terrain objects under low atmospheric visibility conditions, when the use of usual observation methods is not possible, is described. The instrument also allows measuring the distance to the object with an error of no more than 5 m. Author (TAB)

N69-17538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING THE POWER CHARACTERISTICS OF A LASER AMPLIFIER
A. L. Mikaelyan et al 4 Jan. 1968 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Arm. SSR (Erevan), v. 43, no. 3, 1966 p 133-137
(AD-679713; FTD-HT-23-1439-67) Avail: CFSTI CSCL 20/5

The master laser consisted of a ruby rod 120 mm long and 6.5 mm in diameter pumped by a 500-j flashlamp. The laser output was Q-switched by a rotating (20,000 rpm) prism and consisted of 0.2-j 50-nanosec pulses. The laser amplifier used ruby rods 120 and 240 mm long. The beam energy was measured by means of a calorimeter with a sensitivity of 300 microwatts/j. The gain of a 24-cm laser amplifier was shown to decrease with increasing output energy. To eliminate interference by regeneration, the rod ends were set at angles of 15-20 min. with the mirror. The maximum gain was observed at indication angles of about 5 min. Further increase to about 15 min. resulted in the traveling-wave operation. Author (TAB)

N69-17550# Bell and Howell Research Center, Pasadena, Calif.
INDIUM ARSENIDE-PHOSPHIDE INJECTION LASERS Final Report, 1 Nov. 1967-31 Oct. 1968
Robert K. Willardson, Alan G. Thompson, and Bernd Ross Nov. 1968 121 p refs
(Contract N00014-68-C-0219; Proj. Defender)
(AD-679908; BH-ONR-2) Avail: CFSTI CSCL 20/5

The indium arsenide-phosphide alloy system has been studied. The compound InP was prepared by directional freezing, and from Hall effect measurements the segregation coefficients for S, Se, Te, Sn and Zn were derived, as well as the variation of electron mobility with carrier concentration over the range from 2 x 10 to the 16th power to 3 x 10 to the 19th power/cc. Ingots of the alloys have been grown by the Czochralski and liquid encapsulation (B2O3) techniques; these were polycrystalline but with large grains. Lattice parameters were obtained by X-ray powder photography, and a phase diagram constructed. Carrier concentrations and mobilities were obtained from Hall effect measurements. The preparation of laser diodes was studied by investigating diffusion, contact problems and Fabry-Perot cavity fabrication. Stimulated light emission was observed, with thresholds as low as 2000 A/sq cm at 77K and lasing up to 150K. A wavelength of 1.060 microns was achieved from lasing diodes by adjusting the alloy composition, fine tuning being accomplished by a small temperature adjustment. Author (TAB)

N69-17582# Naval Research Lab., Washington, D. C.
NITROGEN LASER POWER DENSITY AND SOME DESIGN CONSIDERATIONS Final Report
A. W. Ali and Nancy V. Alberico (Catholic Univ. of Am.) Oct. 1968 14 p refs
(Contract N00014-66-C-0043; ARPA Order 660)
(AD-679569; NRL-6771) Avail: CFSTI CSCL 20/5

The laser power density and its time history from a pulsed molecular nitrogen laser were calculated using the theory of Ali, Kolb, and Anderson. The dependence of the power density and its duration on the fill pressure and on various parameters of an electric circuit, in which the nitrogen gas acts as a variable resistor, was examined. It is known that the peak power density increases in a circuit with low inductance and high capacitor voltage and that the energy density is optimum at a fill pressure of approximately 30 Torr. Based on these premises and the gain calculations, some design considerations were also studied. Author (TAB)

N69-17646# General Precision Systems, Inc., Little Falls, N. J. Kearfott Group.
LIQUID LASER PARAMETERS Final Report, 1 Aug. 1964-31 Jul. 1968
William Block, Robert Barnes, and Daniel Grafstein Nov. 1968 75 p refs
(Contract Nonr-4644(00); ARPA Order 306-62)
(AD-679588) Avail: CFSTI CSCL 20/5

This program was designed to study the influence of chemical and physical environmental factors upon the intensity, efficiency, and lifetime of rare earth phosphorescence in liquid systems. The objective of this program was the development of criteria for the selection of optimum coordinating ligands, counter ions and solvents for rare earths so that useful and efficient high power solution lasers could be developed. A large number of rare earth coordination compounds were synthesized and studied both in the solid state and in solution. A considerable amount of useful information was compiled for systems in which lasing could be accomplished through direct optical excitation of the rare earth. It was concluded that light atoms such as hydrogen and deuterium which would contribute to high-energy vibrational frequencies must be removed from the immediate ligand field surrounding the rare earth ion. Vibrational frequencies in the ligand or coordinating solvent should closely match the energy gaps between the initially excited optically pumped level and the emitting level in order to efficiently populate that level by a cascade process. These same vibrational frequencies, however, must be sufficiently different from the frequency of lasing radiation so as not to promote non-radiative transitions from the emitting level. As a direct result of this work, a very highly promising liquid laser system, neodymium oxide dissolved in a mixture of phosphorus oxychloride and tin tetrachloride, was developed. Author (TAB)

N69-17651# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF PULSE ENERGY AT THE OUTPUT OF AN OPTICAL QUANTUM AMPLIFIER OF A RUNNING WAVE ON RUBY
L. D. Khazov 25 Apr. 1968 9 p refs Transl. into ENGLISH from Optiko-Mekhan. Prom. (USSR), v. 34, no. 8, 1967 p 26-28
(AD-679789; FTD-HT-23-1664-67) Avail: CFSTI CSCL 20/5

A formula for the energy density of a pulse at the output of a ruby laser was obtained on the basis of statistical rate equations. The calculation results obtained with the aid of this formula are presented in a series of graphs which make it possible to analyse readily the dependence of the pulse energy on various factors (e.g., crystal temperature) over a wide range of parameters. The calculated curves representing the dependence of pulse energy on the active length of the amplifier are in satisfactory agreement with the experimental data. TAB

N69-17789# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGY METHODS FOR INVESTIGATING CHARACTERISTICS OF RUBY CRYSTALS FOR LASERS
V. A. Chaplygin et al 10 Apr. 1968 10 p Transl. into ENGLISH from Vses. Nauchn. Sessiya (Moscow), 1966 p 9-13
(AD-679867; FTD-HT-23-1649-67) Avail: CFSTI CSCL 20/5

New methods for determining certain parameters of a ruby crystal for a laser are examined. They include chromium ion concentration, effective lifetime, and losses in the crystal based on the energy characteristics of the radiation. Author (TAB)

N69-17907# Institut Franco-Allemand de Recherches, St. Louis, (France).
A LIQUID LASER WITH ORGANIC COLOR PIGMENTS [FLUESSIGKEITSLASER MIT ORGANISCHEN FARBSTOFFEN]
L. Repper 6 Jun. 1967 17 p refs In GERMAN
(ISL-D-5/67) Avail: CFSTI

Discussed is the inductive emission of liquid lasers with organic dyes; these dyes represent a new type of laser. Laser emission mechanism of polymethine dyes is analyzed and it is assumed that these dyes form a four level laser because they contain cis-trans-isomers. The advantages of liquid organic lasers in comparison to solid and gas lasers are pointed out. Author

N69-17929# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROPAGATION OF SHORT DURATION LIGHT PULSES IN A TURBID MEDIUM
A. M. Belyanantsev et al 30 Apr. 1968 18 p refs Transl. into ENGLISH from Izv. Vysshikh Uchenbn. Zavedsnii, Radiofiz. (Gorki), v. 10, no. 4, 1967 p 489-497
(AD-679674; FTD-MT-24-83-68) Avail: CFSTI CSCL 17/8

An analytical investigation is made of time-dependent distortions of a pulse light signal transmitted by a narrow beam through an infinite turbid medium. The analysis proceeds from nonstationary transfer equations and considers single- and double-scattering approximations under conditions of a spherical-isotropic indicatrix. The distortion of the pulse shape at the receiving end and the pulse shape as back-scattered from the thickness of the medium are determined. The effect of the aperture radius of the receiving pupil on the cross-sectional distribution of light intensity and the effect of the distance of the distance of the source are considered, and the relationships are presented in the form of graphs. A criterion is established for taking into account multiple scattering in the estimation of backscattering. Author (TAB)

N69-18155# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BEYOND THE THRESHOLD IS THE HOMELAND OF LASERS AT A SOVIET LAB WAS OBTAINED THE MOST POWERFUL LASER PULSE IN THE WORLD
A. Simonyan 15 Jan. 1968 8 p Transl. into ENGLISH from Komsomol'skaya Pravka (Moscow), no. 111, 1967 p 4
(AD-679818; FTD-HT-23-1284-67) Avail: CFSTI CSCL 20/5

N. Basov, the youngest Soviet Academician and winner of the Lenin and Nobel prizes, is interviewed on the subject of high-intensity laser research at the Lebedev Institute of which he is Deputy Director. The application of optical triggers, developed in Basovs Quantum Electronics Laboratory, in computer technology is briefly discussed. Author (TAB)

N69-18294#
CONTINUOUS WAVE LASER ON THE BASIS OF LaNa $(MoO_4)_2$ Nd TRIVALENT IONIC CRYSTALS OPERATING AT 300°K

A. A. Kaminskii et al. [1968] 3 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 9, no. 5, 1968 p 884-886
Avail: CFSTI

Some parameters of a continuous wave laser utilizing $LaNa(MoO_4)_2$–Nd^{+3} crystals and its generation properties in the pulse mode are presented. The distinguishing peculiarity of the crystals is disorder in structure, which is connected to the statistical nature of the arrangement of the lanthanum and sodium ions. As a result, line broadening of the optical and electron paramagnetic resonance spectra is observed. The excitation threshold of the generation of this type laser is low despite the significance of the luminescence spectrum in the 1.06 μm band. Despite the large width and nonuniform nature of the luminescence line broadening of neodymium ions in lanthanum sodium molybdate crystals, lasers using them have a low excitation threshold and can operate at 300°K in the CW mode. B.P.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-17209# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.
EROSION OF COMMON STRUCTURAL MATERIALS AND THE DEGRADATION OF SUSPENDED PARTICLES IN FLOWING SUSPENSION OF GRAPHITE POWDER IN CARBON DIOXIDE GAS
D. A. Garton, R. I. Hawes, and P. W. Rose Jun. 1968 26 p refs
(AEEW-R-510) Avail: CFSTI; UK: 5s

Experiments were performed to examine the erosion of common materials of construction by a flowing suspension of graphite powder in carbon dioxide gas, and also the degradation of the graphite powder in the suspension. The suspension was circulated through a stainless steel loop at a pressure of 200 psig and bulk fluid temperature of 100–150°C. No change in the weight of pins of mild steel, stainless steel and Zircaloy, placed across the flow stream in a region where the velocity approached 100 ft/sec, could be detected after 350 hours of circulation. Examination of microphotographs of the cross sections of the specimens showed no change in the structure of the metals. Considerable erosion of graphite pins, producing a 6% decrease in the weight, was observed under similar conditions. Author (NSA)

N69-17211*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DIFFUSION BONDING OF TITANIUM TO SIMULATE SIC FUEL TANKAGE COMPONENTS
C. N. Irvine 4 Nov. 1968 41 p refs
(NASA-TM-X-53747) Avail: CFSTI CSCL 13H

Data are presented to show that large simulated titanium alloy gores, skin, and Y-ring segments can be fabricated to the design requirements of the S-1C fuel tank utilizing advanced diffusion bonding technology. This should be directly applicable to the future production of launch vehicle structures which specify a titanium alloy material. Although the roll diffusion bonding technology is concerned primarily with launch vehicle structural development, the information should also be of value to other applications such as the upper flight stages where strength to density ratio and integral construction are important considerations. Author

N69-17253# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Material- und Festkoerperforschung.
TIME-STATE BEHAVIOR AND CREEP BEHAVIOR OF V-Ti AND V-Ti-Nb ALLOYS [ZEITSTAND- UND KRIECHVERHALTEN VON VANADIN- TITAN- UND VANADIN-TITAN-NIOB-LEGIERUNGEN]
H. Boehm and M. Schirra Jun. 1968 60 p In GERMAN
(KFK-774; EUR-3954.D) Avail: CFSTI

The time-state behavior and the creep behavior of the binary V–Ti and ternary V–Ti–Nb alloys were studied in the temperature region over 650°C. The results show the preponderant effect of Ti on the time-state and creep behavior of the alloys. At Ti contents over about 1% the time-state stability decreases with increasing Ti concentration, but the short-term heat stability increases. This is independent of the Nb content. With increasing concentration of Nb, the life was increased; however, the effect of the Nb with increasing life was slight. The best V alloys show long-time stabilities which can scarcely be attained by other materials. The activation energy of the creep in the temperature range about 650° shows a strong dependence on the Ti content, whereas the Nb content is without effect in this region. The results indicate that the time-state behavior and creep behavior of the alloys are also determined at high Ti content by the interaction between Ti and the interstitial impurities. Author (NSA)

N69-17277*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXAMINATION OF OXIDE SCALES ON HEAT RESISTING ALLOYS
Salvatore J. Grisaffe and Carl E. Lowell Washington Feb. 1969 44 p refs
(NASA-TN-D-5019) Avail: CFSTI

Twelve iron, nickel, and cobalt heat resisting alloys were cyclic furnace oxidation tested at from 1400° to 2200°F (1033 to 1478 K) for from 4 to 600 hours. Retained oxide scales and spall were identified using X-ray diffraction combined with X-ray fluorescence analyses. Metallography clarified scale growth sequences. After 600 hours at 2000°F (1366 K), the condition most studied, the best oxidation resistance, as reflected by weight change and spall weight, was exhibited by alloys forming single oxide scales of Al_2O_3 or Cr_2O_3. For alloys that developed multioxide scales, spinel constituent composition or lattice parameter did not correlate with oxidation resistance. Author

N69-17299# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTING WITH PRECISE MULTI-PERFORATING OF SHEET METAL BY MEANS OF EXPLOSIVES [VERSUCHE UEBER GENAUE VIELFACH-LOCHUNGEN DUENNER BLECHE MITTELS SPRENGSTOFFS]
H. G. Otto 29 Dec. 1967 19 p refs In GERMAN
(ISL-T-43/67) Avail: CFSTI

Evaluated were three methods for blasting numerous small holes into thin aluminum sheets by explosive charges and without the use of a press. Two of these methods use moisture and distance; the last one is a dry contact method. Generally, all three methods seem feasible but the degree of technical difficulties involved indicates little economic value. Transl. by G.G.

N69-17320# NOLIT Publishing House, Belgrade (Yugoslavia).
GRAIN GROWTH IN ALPHA-URANIUM
Danica Cerovic *In its* Bull. of the Boris Kidric Inst. of Nucl. Sci., Vol. 17, No. 1 1966 p 37–45 refs (See N69-17315 07-34)
Avail: CFSTI

For the purpose of studying grain growth in uranium, samples were up to 50% deformed by rolling and annealed at 600°C to recrystallize. Fine grains 12 μ in diameter were obtained; they were then annealed at different temperatures and times and changes in the grain size observed. The data obtained allowed calculation of the characteristic parameters of grain growth: rate constants, time exponent and activation energy. Author

N69-17333# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
METALLURGICAL STRUCTURES IN A HIGH URANIUM-SILICON ALLOY
B. S. Wyatt, L. C. Berthiaume, and J. L. Conversi Oct. 1968 39 p refs
(AECL-2761) Avail: Atomic Energy of Can., Ltd., Chalk River: $1.00

The effects of fabrication and heat treatment variables on the structure of a uranium–3.96 wt% silicon alloy were studied using optical microscopy, quantitative metallography, and hardness determinations. It was shown that an optimum temperature exists below the peritectoid temperature where the maximum amount of transformation to U_3Si occurs in a given period of time. The time required to fully transform an as-cast alloy at this optimum temperature is affected by the size of the primary U_3Si_2 dendrites. With a U_3Si_2 particle size of < 12 μm complete transformation can be achieved in four hours. Author

N69-17355# United Kingdom Atomic Energy Authority, Harwell (England).
ELECTRON MICROSCOPY OF SMALL DEFECT CLUSTERS IN IRRADIATED METALS. 2: INVESTIGATIONS ON NEUTRON- AND ION-IRRADIATED COPPER AND NEUTRON-IRRADIATED NICKEL
M. Ruehle 1967 22 p refs Transl. into ENGLISH from Phys. Status Solidi (Ger.), no. 19, 1967 p 279–295
(AERE-Trans-1087) Avail: CFSTI: UK 3s

A study is made of the defects observed in copper after neutron and ion bombardment, and in nickel after neutron irradiation. The true size and the size distribution of the agglomerates may be determined from a quantitative comparison between the contrast width known from theory of contrast and the observed defect sizes. An analysis of the defect type revealed that all the visible defects in copper after neutron or ion bombardment (using an electron microscope with 100 kV- and 40 kV-ions) were formed by the condensation of vacancies. The same results are obtained for the defects observed in neutron-irradiated nickel. The interstitials generated during irradiation must therefore have either annealed out at sinks (grain boundaries, dislocations, vacancies) or agglomerated to defects beyond the present limit of resolution of the electron microscope. A quantitative comparison between the observed defect concentration and the energy distribution of the primary recoil atoms shows that all primary recoil atoms with energies greater than (30 ± 10) keV generate a defect visible in the electron microscope. Author (NSA)

N69-17401# Aerojet-General Corp., Sacramento, Calif. Propulsion Div.
INVESTIGATION OF MECHANISM OF DELAYED FAILURE OF PRESTRESSING STEEL Final Report
J. T. Niemann 8 Jul. 1968 30 p refs
(Contract SA-MR-61)
(PB-180194) Avail: CFSTI CSCL 13M

The tensile and approximate plane-strain fracture toughness properties were determined for one lot of 1 1/4-in. dia. steel prestressing rod. Tests were conducted in the as-received condition and after tempering at temperatures between 700 and 900 degrees F. Circumferentially notched and fatigue precracked samples were exposed under a constant load in either cement extract water or distilled water containing sodium chloride and sodium sulfate to establish the relationship between applied stress and time to failure. The same type of tests were repeated in the distilled water solution with the specimen either the anode or cathode of an electrolytic cell. These studies showed that prestressing wire is subject to delayed failure by the mechanism of hydrogen-stress cracking. USGRDR

N69-17408*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM Quarterly Progress Report, 15 Jan.–15 Apr. 1968
R. W. Harrison 14 Jun. 1968 83 p refs
(Contract NAS3-6474)
(NASA-CR-72452; GESP-144; QPR-12) Avail: CFSTI CSCL 11F

The instrumentation and installation of the T-111 Rankine System Corrosion Test Loop was completed. The test loop was filled with alkali metal and the low-power, all-liquid pretest operation, which includes the checkout and calibration of the loop instrumentation, was completed. Boiling and condensing operation was initiated, but the design operating conditions were not reached due to a leak in the potassium boiler. The loop was drained of alkali metal, and plans are now being prepared for the repair of the boiler. The EM pump and surge tank subassemblies of the 2600°F Lithium Loop have been fabricated. Author

N69-17416# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
MECHANICAL PROPERTIES OF THE GROUP IVB AND VB TRANSITION METAL MONOCARBIDES
Wm. F. Brizes (Pittsburgh Univ.) Apr. 1968 45 p refs
(WANL-TME-1782) Avail: CFSTI

The mechanical behavior of the Group IVB and Group VB monocarbides has been studied on 100% dense samples made by liquid state carburization. The properties investigated were thermal expansion, yield stress, and room temperature hardness as a function of stoichiometry. The activation energy for deformation of niobium carbide was determined from high temperature yield stress data and was found to be 133 kcal/mole, a value that is in good agreement with the activation energy for niobium monocarbide. Author (NSA)

N69-17441 Michigan State Univ., East Lansing.
THE EFFECTS OF SAMPLE SIZE, MAGNETIC FIELD, AND TEMPERATURE ON THE ELECTRICAL RESISTIVITY AND THERMOPOWER OF ALUMINUM
John Bos Van Zytveld (Ph.D. Thesis) 1967 140 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-7979

The absolute thermopower was determined of bulk aluminum from 1.5°K to 300°K. It is was negative at all temperatures, with a negative phonon-drag peak at about 75°K. The thermopower, above 200°K, fits an $AT + B/T$ law; the phonon-drag component, estimated from this relation, constitutes nearly 50% of the total thermopower at 300°K. Preliminary measurements of effects of sample size on thermopower reveal changes in the thermopower below 25°K which can be correlated to sample size. High temperature variations were neither sufficiently reproducible, nor of the right form to allow comparison with theory. Preliminary measurements of the magnetic field dependence of the thermopower of bulk aluminum at ~ 10°K, show an apparent change in sign of the thermopower with increasing magnetic field. This is qualitatively consistent with the change in sign of the Hall coefficient of aluminum with increasing magnetic field. Dissert. Abstr.

N69-17487*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EFFECTS OF WELD HEAT ON THE PROTECTIVE PROPERTIES OF CONVERSION COATINGS
R. H. Higgins 3 Jan. 1969 28 p refs Presented AFML 50th Anniv., Corrosion of Mil. and Aerospace Equipment Symp., Denver, 22–25 May 1967, and ASTRA Conf. on Corrosion Probl. and Control, Kansas City, Mo., 13–14 Sep. 1967
(NASA-TM-X-53808) Avail: CFSTI CSCL 11F

A chromate conversion coating is applied to the Saturn V tank skin sections soon after fabrication. The elevated temperature resulting from subsequent welding processes considerably lowers the amount of corrosion protection afforded by this coating. A test

program was conducted to evaluate the extent of coating degradation on 2219-T87 aluminum alloy and to investigate methods of repairing the degraded areas. The tests showed that the coating was damaged at temperatures exceeding 140°F or for a distance of approximately six inches from the weld. Mechanical removal of the damaged coating followed by a manually applied conversion coating treatment effectively restored the corrosion protection to the damaged areas. Author

N69-17471# Boeing Co., Renton, Wash. Commercial Airplane Div.
STRAIN-CYCLING EFFECTS IN 1100 ALUMINUM
H. A. Moreen Nov. 1968 28 p refs
(AD-679950; D6-23733) Avail: CFSTI CSCL 11/6

In this work, a quantitative analysis is made of the details of the stress-strain behavior in 100 aluminum. Particular interest has been devoted to determining if there is a characteristic shape to the loop and how the loop shape relates to the cyclic strain hardening curve. The relative importance of the transient, pre-saturated behavior has been investigated, as well as the shape prior to saturation. Finally, the observed behavior has been compared to dislocation models of cyclic straining. Author (TAB)

N69-17490# Bettis Atomic Power Lab., Pittsburgh, Pa.
EFFECT OF TEMPERATURE AND TIME ON ZIRCALOY OXIDE FORMATION AND ITS REMOVAL BY PICKLING Interim Memorandum
C. V. Taylor and J. G. Goodwin Sep. 1968 9 p
(Contract AT(11-1)-GEN-14)
(WARD-TM-786) Avail: CFSTI

Results of studies performed to determine the limiting oxide film thickness on Zircaloy which can be removed by pickling are presented. Useful guidelines are given for those engaged in the fabrication of finished Zircaloy components where heating for forming is desirable, but where removal of oxide by mechanical means is difficult or impossible. Also included is information concerning the thickness of oxide formed as a function of time at normal Zircaloy forging, hot rolling, and annealing temperatures and the concomitant depth of oxygen penetration (solid solution) in the metal. The latter data are useful in determining the amount of metal to remove by pickling after the visible oxide is removed from Zircaloy heated to the normal fabrication temperatures. The effect of any working of the metal on the thickness of the oxygen-rich layer must be considered, because the data represent a "worst case" in that they were obtained from plates heated at 1550°F or 1860°F but not reduced in thickness by working. Author (NSA)

N69-17492# ARO, Inc., Arnold Air Force Station, Tenn.
EFFECTS OF MONOMETHYLHYDRAZINE ON CRYOPANEL MATERIALS FOR SPACE SIMULATION CHAMBER PROPULSION TESTS Final Report, Mar.-Aug. 1967
P. G. Waldrep and D. M. Trayer AEDC Dec. 1968 40 p refs
(Contract F40600-69-C-0001)
(AD-679531; AEDC-TR-68-194) Avail: CFSTI CSCL 14/2

The effects of monomethylhydrazine on several commonly used cryopanel materials were investigated. The test conditions approximated those expected during rocket engine tests in a space simulation chamber. Monomethylhydrazine gas pressure was 4 torr at room temperature. Test specimen temperatures were varied between 77 and about 300K. All specimens were tested simultaneously for a total exposure time of 532 hr. Phosphorus deoxidized copper, type 304L stainless steel, and series 1100 aluminum were tested. Some specimens were brazed or welded and some were coated with a black epoxy paint. Several welded and brazed specimens were tested with an imposed bending stress. No microstructural damage occurred to any of the metals. The copper, however, tarnished noticeably, and the cryopanel paint separated from the coated specimens. Author (TAB)

N69-17574# Dayton Univ. Research Inst., Ohio.
A CALCULATION OF THE COHESIVE ENERGY OF THE Ca-Sr ALLOY SYSTEM Technical Report, 1 May-30 Jun. 1968
Joseph E. Davison Wright-Patterson AFB, Ohio AFML Oct. 1968 22 p refs
(Contract F33 615-67-C-1187)
(AD-679769; UDRI-TR-68-23; AFML-TR-68-277) Avail: CFSTI CSCL 11/6

The cohesive energy of the binary alloy system, Ca-Sr, was calculated from a model based on the Wigner-Seitz model for elemental metals. The cohesive energy is expressed as a function of the volumes of the elemental constituents of the alloy. Numerical solutions were obtained for the enthalpy of mixing and the volume change on alloying under the constraint that the cohesive energy is a minimum at the equilibrium volume. Author (TAB)

N69-17643# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATING THE CORROSION RESISTANCE AND THE ELECTROCHEMICAL AND MECHANICAL PROPERTIES OF NIOBIUM-TITANIUM SYSTEM ALLOYS
A. I. Glukhova et al 15 Mar. 1968 17 p refs Transl. into ENGLISH from Korroziya Metallov i Splavov. Sb. Nr. 2 (USSR), 1965 p 29-42
(AD-679730; FTD-HT-23-1665-67) Avail: CFSTI CSCL 11/6

Niobium alloys with 2 - 40% titanium have high corrosion resistance in solutions of mineral acids at a temperature of 40C. An increase in titanium content decreases corrosion resistance. Maximum corrosion is observed in acid media at an energy potential of 100 mv. Formation of a hybrid layer and embrittlement of Me occurs at more negative potentials due to diffusion of H in Me. Author (TAB)

N69-17683# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF VANADIUM, TITANIUM, HAFNIUM AND ZIRCONIUM ON THE RECRYSTALLIZATION OF MOLYBDENUM
V. P. Gol'tsev 25 Jan. 1968 9 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Tekh. Navuk (Minsk), no. 4, 1965 p 53-56
(AD-679712; FTD-HT-23-1206-67) Avail: CFSTI CSCL 11/6

The report discussed the previously observed adverse effect of large contents of aluminum, zirconium, titanium and similar elements on the plasticity of molybdenum alloys and in view of their contributing to an increase in the recrystallization temperature, the author has traced the influence of small additions of vanadium, titanium, hafnium, and zirconium on the recrystallization of molybdenum. Author (TAB)

N69-17692# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
RADIATION EFFECTS ON THE MICROSTRUCTURE OF TUNGSTEN
Robert C. Rau, John Moteff, and Robert L. Ladd [1968] 4 p refs Presented at the 14th Ann. Meeting of the Am. Nucl. Soc., Toronto, 9-13 Jun. 1968
(Contract AT(40-1)-2847)
(GEMP-581; CONF-680601-40) Avail: CFSTI

By transmission electron microscopy the microstructure of neutron irradiated W has been characterized as a function of neutron fluence and post-irradiation annealing temperature, and has been correlated with mechanical properties. Author (NSA)

N69-17717# Martin Co., Denver, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK, VOLUMES 1 AND 2 Final Technical Documentary Report, 1 Jun. 1967-30 Jun. 1968

F. R. Schwartzberg, S. H. Osgood, and R. G. Herzog Wright-Patterson AFB, Ohio AFML Aug. 1968 551 p refs Revised
(Contract F33615-67-C-1794)
(AD-679087; AFML-TDR-64-280-Rev) Avail: CFSTI CSCL 11/6

Data on six new metallic alloys and one class of non-metallic materials are added to the Cryogenic Materials Data Handbook in Supplement No. 4. These additions bring the total of metallic alloys and non-metallic materials covered in the eight data sections of the handbook to 88. A brief treatment of non-metallic materials used in cryogenic service applications, complete with a bibliography of pertinent references, is added to Section I, Miscellaneous Non-metallics. The Materials Guide section was also expanded and now includes descriptions of eight sources where cryogenic data may be obtained. In addition, new data were added to up-date the information on materials already included in the handbook. With Supplement No. 4 the handbook was converted from a single to a two-volume publication. Author (TAB)

N69-17736# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SILICONIZING METALS IN A GLOW DISCHARGE
D. A. Prokoshkin et al 28 Mar. 1968 10 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR, Diffuzionnyye Pokrytiya na Met. (Kiev), 1965 p 38–44
(AD-679505; FTD-HT-23-131-68) Avail: CFSTI CSCL 11/6

Molybdenum, tungsten, niobium and tantalum were siliconized at 1000 to 1200C by glow discharge in a mixture of silicon tetrachloride vapor and hydrogen flowing at a pressure of 40 mm Hg and a rate of 0.5 liters per minute. Author (TAB)

N69-17820# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BASIC PRINCIPLES OF ALLOYING CAST ALUMINUM ALLOYS DEPENDING UPON THEIR OPERATING TEMPERATURE AND AREA OF APPLICATION
I. F. Kolobnev 2 Feb. 1968 14 p refs Transl. into ENGLISH from "Liteynyye Alyuminyevyye Splavy, Svoystva, Tekhnologiya Plavki, Lit'ya i Termicheskoy Obrabotki. Sbornik Statei" 1961 p 5–15
(AD-679656; FTD-HT-23-1505-67) Avail: CFSTI CSCL 11/6

This survey-type paper defines the following operational parameters as determining criteria in the alloying of cast Al alloys: The environmental medium, the cyclic nature and magnitude of the stresses applied, the temperature, and the time of exposure to it. The Soviet literature on the theory of the heat resistance of metallic alloys is briefly reviewed. Author (TAB)

N69-17821# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
STRUCTURE SENSITIVE PROPERTIES OF INTERMEDIATE SOLID SOLUTIONS Final Report, Jun. 1, 1967 -Jul. 31, 1968
J. O. Brittain 15 Aug. 1968 11 p refs
(Grant AF-AFOSR-466-67)
(AD-679641; AFOSR-68-2741) Avail: CFSTI CSCL 11/6

The report is concerned with an investigation of the structure sensitive properties of intermediate solid solutions or intermetallic compounds NiAl, CoAl, NiGa, and CoGa. The optical properties of the beta phases of NiAl, NiGa, CoAl and CoGa indicate that some of these alloys show free-electron behavior below photon energies of about 1 eV. The electrical resistivity of the four beta-alloys indicate that the alloys are metallic but not good conductors. Author (TAB)

N69-17822# California Univ., Livermore. Lawrence Radiation Lab.
ACOUSTIC EMISSIONS GENERATED DURING PHASE TRANSFORMATIONS IN METALS AND ALLOYS
R. G. Liptai, H. L. Dunegan, and C. A. Tatro 6 Sep. 1968 9 p refs
(Contract W-7405-ENG-48)
(UCRL-50525) Avail: CFSTI

Phase transformations in metals and alloys usually are grouped in one of two general categories: nucleation-and-growth, or martensitic (shear) transformations. The choice depends on the atomic mechanism involved in the transformation. Unlike the nucleation-and-growth process, which involves thermal activation and diffusion, martensitic transformations are diffusionless reactions characterized by cooperative movements of atoms through small distances relative to neighboring atoms. Acoustic emissions are the stress waves or lattice vibrations that are generated during these shear-like reactions. Emission analysis has been used for material evaluation and for characterization of martensitic transformations. The use of emission analysis and the experimental results are discussed. Metallurgical processes other than martensitic phase transformations can generate acoustic emissions. Emission analysis of these processes for material evaluation is also discussed. An electrosonic technique is used to detect acoustic emission in the frequency range between 90 to 200 kHz. Author (NSA)

N69-17837# Illinois Univ., Urbana. Dept. of Mining Metallurgy and Petroleum Engineering.
THE STUDY OF POINT DEFECTS IN CsCl ORDERED ALLOYS AND OTHER INTERMETALLIC COMPOUNDS Final Report
David S. Lieberman 25 Nov. 1968 11 p refs
(Grant AF-AFOSR-900-65)
(AD-679610; AFOSR-68-2644) Avail: CFSTI CSCL 11/6

A summary is given of radio-tracer diffusion studies which were made on the intermetallic phases beta-AuZn and FeCo. Proper selection of isotopes in the two cases permitted the simultaneous determination of the diffusion coefficient of both species in the two alloys. Pressure measurements were also made to provide knowledge about the activation volume for diffusion. A field-ion-microscope technique is being developed for investigation of kinetics of ordering on an atomic scale. TAB

N69-17861 Washington Univ., St. Louis, Mo.
RESIDUAL STRESS DUE TO INCLUSION AND DISTORTION OF DOMAIN PATTERN IN INGOT IRON
Samiron Kumar Chatterjee (Ph.D. Thesis) 1968 207 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-10792

The present investigation was undertaken with a view to study strain fields around inclusions, present in a dispersed state in ingot iron. Extensive studies revealed that much research has been carried out on the strain-field around an inclusion using theories of elasticity. However, a quantitative analysis using real material was never done. From the beginning, it was decided that a ferromagnetic property of iron would be used for the stress analysis. It was postulated that the domain pattern would be distorted near the inclusion. Attempts to predict modification of the domain pattern due to the presence of an inclusion have been made by Kersten and Neel. Kersten pointed out that the domain wall should pass through the diametrical plane of the inclusions to minimize the wall area energy. Dissert. Abstr.

N69-17882 Illinois Univ., Urbana.
SUB-GRAIN STRUCTURE OF MACHINED COPPER AND STAINLESS STEEL
Alan Burgess Draper (Ph.D. Thesis) 1967 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-8063

It has been shown that there is a definite correlation between machining parameters, the physical properties of a chip, and its optical and transmission electron microstructure. Cross sections from machined chips of electrolytic tough pitch copper and type 304 stainless steel were examined by optical and electron microscopy at magnifications from 75 X to 375,000 X. The chips were produced at a very low cutting speed (2 5/8 ipm) to minimize thermal effects within the material, and at depths of cut varying from 0.002 in. to 0.015 in. The specimens for transmission electron microscopy were electrochemically thinned to produce a foil representative of

the centerline of the chip. The microstructures were correlated with the microhardness of the original and machined material and with the machining forces as determined by dynamometer data. The shearing forces were calculated according to the Ernst-Merchant model of orthogonal metal cutting. Dissert. Abstr.

N69-17894# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NATURE OF THE BRITTLENESS OF MOLYBDENUM
M. V. Maltsev et al 25 Jan. 1968 9 p refs Transl. into ENGLISH from Akad. Nauk. UkRSSR. Fiz. Priroda Khrupkogo Razrusheniya Metallov (Kiev), 1965 p 125–130
(AD-679808; FTD-HT-23-1195-67) Avail: CFSTI CSCL 11/6

The report discusses the low-temperature properties of molybdenum alloys. TAB

N69-17910# Institut Franco-Allemand de Recherches, St. Louis (France).
DETONATION TENACITY AND MECHANICAL PROPERTIES OF TUBE STEELS [SPENGZAEHIGKEIT UND MECHANISCHE EIGENSCHAFTEN VON ROHRSTAEHLEN]
H. Haensel 9 May 1967 17 p refs In GERMAN
(ISL-3/67) Avail: CFSTI

Reviewed are studies on burst resistance problems and the correlation of burst resistance data with mechanical properties of tubular steels. Burst resistance test results are not related to results from tensile and notch impact tests. It is concluded that quantitative burst resistance tests are only applicable in relation to sample dimensions and explosives used in above described studies. Author

N69-17951 Iowa Univ., Iowa City.
THE EFFECT OF CYCLIC STRESSING ON THE YIELD BEHAVIOR OF MOLYBDENUM
Robert George Dubensky (Ph.D. Thesis) 1968 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-10651

The effect of stress cycling on the yield behavior of low carbon steels has been investigated and it was reported that the upper yield point was removed under certain stress precycling conditions. The hypothesis is presented that similar changes are induced in the yield behavior of certain other body centered cubic metals. Autographic tensile load deformation curves were plotted after precycling the molybdenum specimens. The range of fully reversed axial stresses was from below the fatigue limit to approximately the yield point. Quantitative values, of both the stress magnitude and the number of stress precycles that remove the yield point, were determined. The effect of aging on the stress cycling induced changes in yield behavior was determined. A model was presented to explain the yield point removal by stress precycling in body-centered cubic metals in terms of dynamic dislocation concepts. Dissert. Abstr.

N69-17971# Bureau of Mines, Washington, D. C.
CORROSION PROPERTIES OF THE TZM AND MOLYBDENUM-30 TUNGSTEN ALLOYS
W. L. Acherman, J. P. Carter, and David Schlain Aug. 1968 28 p refs
(RI-7189; PB-180204) Avail: CFSTI CSCL 11F

The chemical and galvanic corrosion behavior of the TZM and molybdenum-30 tungsten alloys was found to be generally equal or superior to that of unalloyed molybdenum in many aqueous solutions of acids, bases, and salts. Notable exceptions occurred in 1 N nitric acid, where both alloys corroded appreciably faster than molybdenum. In mercuric chloride solutions, the TZM alloy was susceptible to a type of crevice corrosion which was not due to differential aeration. The alloys were usually not adversely affected by contact with dissimilar metals in galvanic couple experiments, but the dissimilar metals sometimes corroded galvanically. Both alloys were resistant to substitute ocean water spray at 60°C. Author (USGRDR)

N69-17989# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE "HARDENABILITY" OF Zr-1.2 WEIGHT % Cr-0.1 WEIGHT % Fe
W. M. Rumball Nov. 1968 26 p refs
(AECL-3050) Avail: Atomic Energy of Can., Ltd., Chalk River $1.00

The behaviour of the alloy Zr-1.2 wt% Cr-0.1 wt% Fe to quench hardening has been determined as a function of cooling rate from the quenching temperature. A maximum hardness of about 360 VPN occurs on cooling a 1400 ppm oxygen alloy at > 2000 degC/s, this hardness being unaffected by β quenching temperature, soaking time or β grain size. Cooling rates calculated using heat flow theory compared well with experimental data. The necessary heat transfer parameters are evaluated for this alloy and data are presented to enable the cooling rates of semi-infinite cylinders, sheets and thin-walled tubes to be calculated. These calculations enable the hardening response of these regular solids to be derived and in this way the cross-sectional hardness profiles of a range of fuel sheathing and pressure tubing sizes have been predicted. Author

N69-18004# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF THE FATIGUE STRENGTH OF UNALLOYED TITANIUM [DAUERFESTIGKEITSUNTERSUCHUNGEN AN REINTITAN]
M. Hempel and E. Hillnhagen Jul. 1968 46 p refs Transl. into ENGLISH from Arch. Eisenhuettenw (Duesseldorf), v. 33, no. 8, 1968 p 567–581
(RAE-Lib-Trans-1310) Avail: CFSTI

Fatigue tests have been carried out at room temperature on flat and round test samples from four melts of pure unalloyed titanium under tension-compression, rotating-bend, plane-bend and alternating torsional stresses. Effect on the fatigue strength of the surface condition, of heat treatment, of melting conditions, of hydrogen content and of type of stress is reported. The fatigue-stress concentration factors were determined and the effects of cold reduction, rolling texture and loading frequency on fatigue strength were measured. Metallographic investigations were made on the formation of slip lines and the propagation of fatigue fracture cracks. The results are compared with published data. Author

N69-18011*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
A PROPOSED METHOD FOR ESTIMATING RESIDUAL MATRIX CHEMISTRY IN NICKEL-BASE SUPERALLOYS
R. L. Dreshfield Washington 1969 20 p refs
(NASA-TM-X-52530) Avail: CFSTI CSCL 11F

A method of estimating the residual matrix (gamma phase) composition of nickel-base superalloys is proposed. This method is based on geometric analysis of multicomponent phase diagrams and, for those elements where no phase diagrams are available, on the currently accepted phase computation methods. Calculations of residual matrix for IN 713C, IN 713LC, IN 731X, and U 700 are generally in good agreement with those reported in the literature. Author

N69-18016# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF COMBINED COATINGS IN RADIATION HEATING OF BLANKS
I. A. Zernov 24 Jan. 1968 11 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), v. 9, no. 4, 1966 p 136–141
(AD-679736; FTD-HT-23-1129-67) Avail: CFSTI CSCL 13/8

In a search for a method for controlling deformations in sheet metal forming, experimental and theoretical studies were made to determine the effect of various coatings on the temperature distribution on the metal surface. Several coating materials, such as a colloidal graphite suspension in water and molybdenum disulfide, were tested. The coatings were applied to certain parts of the sheet blanks prior to heating and forming. Author (TAB)

N69-18020# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PECULIARITIES OF THE RECRYSTALLIZATION OF ALLOY EI437B
N. N. Lipchin, S. A. Kokovyakina, and V. N. Shubin Apr. 1968 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 9, no. 8, 1966 p 152–156
(AD-679510; FTD-HT-23-214-68) Avail: CFSTI CSCL 11/6

The grain sizes and uniformity in alloys for high-temperature use are discussed. The purpose of this study is to investigate the effect of admixture phases of an alloy and plastic deformation on the character of grain growth, and also to clarify the simultaneous effect of these factors on the structure formation. Author (TAB)

N69-18027*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
DEVELOPMENT OF HIGH TEMPERATURE ELECTRICAL MATERIALS Quarterly Report, 20 Jul.–19 Oct. 1968
J. W. Toth ,ed. Nov. 1968 97 p refs
(Contract NAS3-10941)
(NASA-CR-99335; WAED-68.46E; QR-2) Avail: CFSTI CSCL 11F

The high-temperature alternator stator and bore seal successfully completed a 10,000-hour test period at 1300°F in a simulated space environment. Stator insulation (rigid alumina slot liners and S glass) and conductor (Inconel-clad silver) performance remained constant. A single-wafer pyrolytic boron nitride capacitor with platinum electrodes exhibited good stability during a 50 cycle, 300° to 1300°F thermal shock test conducted in vacuum ($< 1 \times 10^{-6}$ torr). Capacitance and dissipation factor remained essentially unchanged during testing. Pyrolytic boron nitride slot insulation has been sliced and rough-machined for a compression fit high-temperature statorette. The electrical discharge machined iron–cobalt statorette laminations were electron beam welded. Statorette stack slot sides appear very smooth. Author

N69-18054# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
DIE-QUENCH FORMING OF 17-7 PH STAINLESS STEEL SHEET
Steve H. Lee Nov. 1968 27 p refs
(FSR-AD8-02-68.1) Avail: Issuing Activity

A die-quench forming process for 17-7 PH stainless steel sheet was developed. Die-quench forming parameters and tool design criteria were determined for 0.020 and 0.050-inch-thick sheet. A high-temperature forming lubricant was selected. The effects of conditioning and aging factors on tensile properties of die-quench formed parts were studied. The process developed produces distortion-free 17-7 PH stainless steel parts with acceptable mechanical properties. A process specification is being issued to make possible rapid implementation of die-quench forming on several A-6A, E-2A, and F-111 production parts. Author

N69-18075 Pennsylvania State Univ., University Park.
A STUDY OF GRAIN BOUNDARY SEGREGATION OF PHOSPHORUS IN SILICON IRON
David Arthur Shores (Ph.D. Thesis) 1967 82 p
Avail: Univ. Microfilms: HC $4.45/Microfilm $3.00 Order No. 68-8743

The purpose of the work described in this thesis was to measure quantitatively the equilibrium grain boundary segregation of phosphorus in silicon iron. Measurements were made on two alloys, differing in the concentration of phosphorus, which had been equilibrated at a variety of temperatures. Two alloys, Fe-3.4Si 1P and Fe-3.4Si-0.03P, were made by melting a basis silicon iron alloy together with 2 to 5 mc of radioactive phosphorus-32 and some ordinary phosphorus as Fe_3P. Working specimens in the form of small coupons were cut from strip that had been produced by hot rolling and cold rolling the ingots. All specimens were initially heat treated at 1000° in hydrogen for 24 hrs, after which groups of specimens were equilibrated at various temperatures ranging from 400° to 1000°C, followed by water quenching. Dissert. Abstr.

N69-18128 Case Western Reserve Univ., Cleveland, Ohio.
EFFECTS AND NEUTRALIZATION OF TRACE ELEMENTS IN GRAY AND DUCTILE IRON
Charles Earl Bates (Ph.D. Thesis) 1967 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-10139

An investigation of the effect of small amounts of six trace elements on the mode of solidification, microstruxture and tensile strength of gray and ductile cast irons was conducted. The elements studied were lead, bismuth, tellurium, titanium, antimony and zinc in gray iron and lead, bismuth, tellurium, titanium, antimony and arsenic in ductile iron. Selected combinations of these elements were considered in ductile iron. Dissert. Abstr.

N69-18194# Northwestern Univ., Evanston, Ill. Dept of Materials Science.
THE EFFECTS OF THERMO-MECHANICAL TREATMENTS ON THE SUBSTRUCTURE IN METALS AND ALLOYS Final Report, 15 Jun. 1961–Dec. 1968
J. B. Cohen 1 Jan. 1969 11 p refs
(Contract Nonr-1228(20))
(AD-679914) Avail: CFSTI CSCL 11/6

Research highlights are summarized on the effects of thermomechanical treatments on the substructure of metals and alloys. Twinning, shock and plastic deformation, dislocation mechanisms, and X ray structural techniques are reviewed. A list of publications and reports is included. B.P.

N69-18228# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
ELABORATION OF REFRACTORY ALLOYS IN POWDER, IN FIBERS AND IN SINTERED BILLETS BY A THERMOCHEMICAL METHOD [ELABORATION D'ALLIAGES REFRACTAIRES EN POUDRES, EN FIBRES ET EN BILLETTES FRITTEES PAR VOIE THERMOCHIMIQUE]
Philippe Galmiche, Andre Hivert, and Michel Marty 1968 22 p refs In FRENCH; ENGLISH summary Presented at the 6th Plansee de re Metallica Symp. on the Refractory Metals, Reutte, Austria, 24–28 Jun. 1968 Submitted for publication
(ONERA-TP-636) Avail: CFSTI

The ONERA processes of metallic cementations in the gaseous phase have been successfully applied, at the laboratory scale but also at the industrial scale, for the elaboration of refractory alloys in powder, in fibers and in sintered billets. After a recall of the principles and of the general conditions of the thermochemical treatments used, the various results obtained are described, a particular emphasis being placed on the elaboration of dispersed phase alloys with a complex matrix of the T.D. nickel type. ESRO

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-17290# North Dakota State Univ., Fargo. Engineering Experiment Station.
STUDY DETERMINATION OF STRENGTH EQUIVALENCIES OF BITUMINOUS MIXES Final Report

Suresh P. Brahma Aug. 1968 64 p refs Supported by the Bur. of Public Roads, Washington, D. C.
(PB-180243; Ser-14) Avail: CFSTI CSCL 13B

A series of bituminous mixes were made consisting of ten sources of local gravel aggregates in combination with 120–150 penetration asphalt cement, RC-250 or RC-800. The aggregates were used in both their natural gradation and gradations modified to pass North Dakota specifications. Marshall stability, flow, percent air voids, percent voids in mineral aggregates, density, effective asphalt content, optimum asphalt content, angle of internal friction, and cohesion were determined. A good quality crushed stone aggregate was used as a control. A new method for preparing and testing cold mixes was developed. Author (USGRDR)

N69-17362# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MECHANICAL TESTING OF SILICA PHENOLIC COMPOSITES AT ELEVATED TEMPERATURES
R. D. Carnahan Oct. 1968 30 p refs
(Contract F04701-68-C-0200)
(AD-679981; TR-0200(4250-10)-1) Avail: CFSTI CSCL 11/4

The principal objective of this study was to determine the mechanical properties, tensile yield, ultimate strength, and Youngs modulus of elasticity of a silica fabric reinforced phenolic composite at temperatures above the cure level. The proposed application for this class of material as an ablative liner of a rocket nozzle skirt extension requires such engineering data for temperatures ranging up to 3000F so that design safety margins can be based on a thermostructural analysis. Author (TAB)

N69-17389# Japan Atomic Energy Research Inst., Tokyo.
ANNEALING EFFECTS ON THE INTERNAL FRICTION AND THE DYNAMIC MODULUS OF PILE-IRRADIATED GRAPHITE
M. H. Saito and K. Kawamura Jul. 1967 10 p refs Transl. into ENGLISH from Tanso (Tokyo), no. 51, Nov. 1967 p 7–10
(NSJ-tr-115) Avail: CFSTI

A recter grade graphite pile irradiated to the total dose of 5.8×10^{20} nvt (Ni) at 30°C was stepwise annealed between 100° and 2150°C, and examined for measurement of internal friction and of dynamic modulus at temperatures from 300° down to 80°K. The recovery process has been found to consist of three stages; the first stage caused by the annealing between 100° and 500°C, the second by that in the range 600° to 1150°C, and the third by the treatment between 1200° to 2150°C. The dynamic modulus recovers for the most part in the first stage, while the internal friction indicates little change. On the other hand, the recovery of internal friction takes place mostly in the third stage where the dynamic modulus shows a slight fall-off. In the second stage everything seems to have a recess. An analysis in the framework of the Granato–Luecke theory has yielded a considerable success in the evaluation of the interaction energy between dislocations and radiation-induced defects. NSA

N69-17406# Naval Research Lab., Washington, D. C.
NONDESTRUCTIVE TESTING FOR VOID CONTENT IN GLASS-FILAMENT WOUND COMPOSITES Final Report
B. E. Walker, Jr., C. T. Ewing, and R. R. Miller 4 Oct. 1968 19 p refs
(AD-679573; NRL-6775) Avail: CFSTI CSCL 11/4

Precise nondestructive methods for void determinations on glass-filament-wound composites in the form of rings and ring segments were tested for feasibility, with particular emphasis on the 0- to 3-volume-% void region. Experimental data related to void content are presented for several possibilities - infrared transmission, backscatter from laser transmission, density measurements, and corona discharge inception. The problems associated with these methods are discussed, and the feasibility of a nondestructive test method for void determinations on rings is demonstrated in comparison with destructive void results. Author (TAB)

N69-17468# Bureau of Public Roads, Washington, D. C.
IN-SERVICE DEGRADATION OF BASE COURSE AGGREGATES
Karl H. Dunn (Wis. Dept. of Transportation) Jun. 1968 43 p refs
(PB-180193) Avail: CFSTI CSCL 13M

A limited field study was conducted to determine the amount of degradation that may occur in untreated aggregate base courses as a result of manipulation, compaction and service exposure. The principal base aggregate types available, hard and soft crushed dolomite, and dolomitic and igneous gravels, were included in the study. Author (USGRDR)

N69-17531# Aerospace Corp., El Segundo, Calif. Lab. Operations.
DETERMINATION OF WICKING PROPERTIES OF COMPRESSIBLE MATERIALS FOR HEAT PIPE APPLICATIONS, MARCH 1967–MARCH 1968
R. A. Farran and K. E. Starner Jul. 1968 51 p refs
(Contract F04701-68-C-0200)
(AD-679975; TR-0200(4240-10)-7; SAMSO-TR-68-428) Avail: CFSTI CSCL 11/5

An experimental program was conducted to develop techniques for determining the wicking characteristics of nonrigid materials for potential use in heat pipes. The principal quantities of interest are effective pore size (to calculate a driving potential for capillary pumping of liquids) and permeability (to establish resistance to liquid flow). Compressible wicking materials do not readily lend themselves to some of the more conventional procedures used for determining flow properties as, e.g., in measuring permeability by forcing a liquid through a rigid, porous material after which flow rate and pressure drop measurements are used to calculate permeability. Consequently, other methods were investigated. Experiments were conducted with woven sleeving to determine the wicking characteristics mentioned above. Results of these tests are presented and compared with performance predicted from theory. Author (TAB)

N69-17584# Naval Research Lab., Washington, D. C.
DETERMINATION OF THE ESTER COMPOSITION OF NEOPENTYL POLYOL ESTER LUBRICANTS Interim Report
P. J. Sniegodki Oct. 1968 19 p refs
(AD-679572; NRL-6750) Avail: CFSTI CSCL 11/8

Methods of gas-liquid chromatography and thin-layer chromatography have been applied to the analysis of neopentyl polyol ester lubricants. By direct programmed-temperature gas chromatography of the lubricants, the components were separated according to volatility; in most cases resolution was adequate for semiquantitative analysis. Gas-liquid chromatographic analysis of the free acids produced by hydrolysis of the sample revealed the acyl composition. The parent polyols were determined by programmed-temperature gas chromatography of their valerate esters. A semipreparative thin-layer chromatographic method permitted the isolation of the three main ester types--trimethylol propane, pentaerythritol, and dipentaerythritol for further analysis. By a combination of these analytical methods the actual ester composition of the lubricant may be determined. Such detailed information had not previously been accessible by analytical procedures. Author (TAB)

N69-17604# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Advanced Development Program.
POLYIMIDE ADHESIVE BONDING FOR ELEVATED TEMPERATURE SERVICE
John Mahon Nov. 1968 71 p refs
(FSR-AD8-05-68.1) Avail: CFSTI

This program was undertaken to evaluate the new heat-resistant polymide adhesives. Lap shear tests conducted on PH 15-7 Mo steel and Ti–8Al–1Mo–1V titanium alloy specimens and flatwise tensile tests conducted on Ti–8Al–6V–2Sn/steel honeycomb sandwich structures thermally conditioned at temperatures up to 700°F, resulted in the elimination of the XE-141 and DP-5505

adhesives from the program. Seven titanium pretreatments were also evaluated for use with the FM-34, Metlbond 840, and DP-5515 adhesives. The DP-5515 adhesive was a late addition to the program. Dry honing with aluminum oxide grit followed by immersion in Pasa Jell 107M and the proprietary Lubeco 300 process were found to be superior to the other methods evaluated. The FM-34 and DP-5515 adhesives were tested against Specification MMM-A-132 using titanium adherends pretreated with the dry honing/Pasa Jell 107M method. Both adhesives met the fatigue strength, creep rupture, salt spray, humidity, and fluid immersion requirements of this specification. Author

N69-17666# California State Div. of Highways. Materials and Research Dept.
STATISTICAL QUALITY CONTROL OF HIGHWAY CONSTRUCTION MATERIALS Final Report
George B. Sherman and Robert O. Watkins May 1968 35 p refs Prepared in cooperation with the US Dept. of Transportation
(M/R-631133-9; PB-180260) Avail: CFSTI CSCL 13B

A summary of the findings of several reports on statistical quality control of highway construction material is presented. The advantages and limitations of the present control procedures are discussed. USGRDR

N69-17678# Ohio State Univ., Columbus. Engineering Experiment Station.
STRIPPING IN HOT-MIXED SAND-ASPHALT MIXTURES Final Report
Kamran Majidzadeh Jul. 1968 45 p refs Sponsored by the Fla. State Road Dept. and the US Bur. of Public Roads
(EES-293; PB-180236) Avail: CFSTI CSCL 13B

The paper reviews the fundamental concepts relating to adhesion and the stripping phenomena in bituminous mixtures. In this study, saturated sand-asphalt mixtures are subjected to repeated trial and hydrostatic pressure and the reduction in the unconfined compressive strength due to the effect of water is investigated. The study shows the improved characteristics of the sand-asphalt mixture containing an antistripping agent and the mixture with less air voids. It is pointed out that reduction in void content either by compaction or by a change in mixture composition can be used as a preventive measure in the field. The study demonstrates an improved test and preconditioning procedure for the investigation of the effect of water or bituminous mixtures. USGRDR

N69-17685# Gulf General Atomic, San Diego, Calif.
EVALUATION OF GLCC GRADE H-327 GRAPHITE LOGS
C. Meyers 21 Jun. 1968 368 p refs
(Contract AT(04-3)-633)
(GAMD-8689) Avail: CFSTI

A series of tests has been performed to evaluate five logs from pilot-lot 340 of GLCC grade H-327 graphite with regard to mechanical and thermal/physical properties. The mechanical properties examined included ultimate compressive strength (UCS), ultimate tensile strength (UTS), strain-to-fracture (ϵ_f), tensile modulus of elasticity (E_T), and tensile secant modulus of elasticity (E_s). The UCS mean parallel to log axis (PL) values ranged from 3678 psi (log 4) to 4698 psi (log 3), and the mean perpendicular to log axis (PR) values ranged from 3433 psi (log 4) to 4214 psi (log 3). The five-log conglomerate UTS mean PL values (Type III configuration) showed a gradient in the log-radial direction: near centerline (NRCL)... 1173 psi, near mid-radius (NRMR)... 1351 psi, and near edge (NREG)... 2218 psi. A similar set of conglomerate PR mean values revealed nearly equal NRCL and NREG values, with a dip at NRMR: NRCL... 1000 psi, NRMR... 773 psi, and NREG... 961 psi. No significant influence on results for Type III samples was found for those samples that broke within one diameter from the end attachment. Author (NSA)

N69-17877# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERSTRENGTH MATERIAL-CERAMIC FIBER
Ting Kou Feb. 1968 8 p Transl. into ENGLISH from K'o Hsueh Hsu Pao (Peking), no. 1/2, 1965 p 19-20
(AD-679710; FTD-HT-23-1020-67) Avail: CFSTI CSCL 11/6

Ceramic fibers are characterized by hardness and strength due to low structural defects and surface cleavage. Ceramic fiber whiskers surpass steel whiskers in density, strength, and heat-resistance. Ceramic fiber whiskers can be adhered and protected by adhesives for use in place of steel as structural material for high temperature duties. Fine ceramic fiber whiskers under two microns in diameter are available. Strength of some ceramic fiber whiskers has approached theoretical values. Some ceramic fibers have been applied to the spacecraft industry. Problem areas in ceramic fiber production are the high cost, and the difficulties in application and processing. Author (TAB)

N69-17972# Gulf General Atomic, San Diego, Calif.
EVALUATION OF VCC GRADE TS-814 (AGOT-NP) GRAPHITE LOG
C. Meyers 9 Jul. 1968 34 p refs
(Contract AT(04-3)-633)
(GAMD-8737) Avail: CFSTI

A midlength slab from one 17-inch-diameter log of UCC grade TS-814 graphite was sampled, and measurements were performed on mechanical and thermal/physical properties. Tensile tests yielded results for ultimate tensile strength, strain-to-fracture, tensile modulus of elasticity, and tensile secant modulus of elasticity, at near edge, near midradius, and near centerline radial locations within this slab. Thermal expansion tests were conducted on two groups of PR samples and on one PL sample. Thermal conductivities of these same sample groups were measured. The mechanical and thermal/physical properties were within limits specified by GGA for Fort St. Vrain reactor fuel element graphite. Author (NSA)

N69-17981# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NON-METALLIC AERONAUTICAL MATERIAL OF GREAT FUTURE: GLASS STEEL
Soong Cheng 9 Feb. 1968 8 p Transl. into ENGLISH from Hang K'ung Chih Shih (China), v. 2, no. 11, 1965 p 10-11
(AD-679689; FTD-HT-23-592-67) Avail: CFSTI CSCL 11/4

A general discussion is given on the development of reinforced plastics. The composition, the main types, and the applications of reinforced plastics are covered. The major properties of the different types of plastics are compared. Author (TAB)

N69-17983# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORCE EFFECT ON A UNIFORM ELECTRICAL FIELD ON A SINGLE FIBER
A. T. Nagi-Zade 23 May 1968 19 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Elektromekhan. (Novocherkassk), no. 1, 1967 p 21-26
(AD-679677; FTD-MT-24-91-68) Avail: CFSTI CSCL 11/5

The purpose of the article is to discuss the theoretical possibility of devising an industrial textile process for aligning, straightening, and transporting individual fibers by means of an applied uniform electrical field. Because of the complex configuration of a fiber, a dielectric ellipsoid is substituted to calculate the approximate pondermotive forces. Equations of vector forces are constructed for each of the processes involved, but no actual devices are suggested. Author (TAB)

N69-18068*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CRYOGENIC TECHNOLOGY RESEARCH AT MSFC
Raymond L. Gause, Douglas A. Gilstad, E. Haschel Hyde, Clyde D. Nevins, James M. Stuckey et al *In its* Res. Achievements Rev., 1968, Vol. 2 92 p refs (See N69-18059 07-34)
Avail: CFSTI CSCL 11G

The thermal aspects of the helium purged 8.36 μ aluminized mylar insulation system applied to a 2.67 m. diameter tank are

discussed, along with future and requirements. The structural design of propellant tankage for long term cryogenic storage is considered. Manufacturing techniques and processes are described which are used to apply high performance multilayer insulation systems to flight type cryogenic tanks. The methods used in the application of helium purged and pre-evacuated concepts are reported. A combined high performance multilayer insulation and micrometeroid protection system was developed for cryogenic tanks in outer space. The helium purged system consisted of an outer micrometeoroid bumper of polyurethane resin impregnated glass cloth and a multilayer insulation of double aluminized Mylar film reflective shields and thin sliced polyurethane foam spacers. Project Rover and the nuclear engine for rocket vehicle applications (NERVA) are described. The nuclear ground test module (NGTM) program is discussed and the relationship between the NGTM and NERVA programs established. An assessment of the status of cryogenic insulation development is presented. B.P.

N69-18087#
ON A THEORETICAL ESTIMATE OF THE INFLUENCE OF THE STRAIN RATE ON THE RESISTANCE TO FRACTURE OF SOFT, CROSSED-WARP BONDED PLASTICS
E. S. Umanskii [1968] 5 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR, Ser. Fiz.-Tekh. (Kiev), no. 12, 1966 p 1561–1565
Avail: CFSTI

The theoretical estimation of the transient and creep strength of specimens of soft bonded plastics on oriented and crossed warps is considered by starting from the assumption that the fibers in each comb deviate from the principal direction by identical angles. Application of the statistical theory of strength to such collections of fibers affords a possibility for a theoretical estimation of the influences of fiber type, composition, the nature of their arrangement in the warp, and the quantities of fiber and film in the material on the transient and creep strengths. Author

N69-18157# Society of Plastics Engineers, Inc., New York.
DESIGN OF EXPERIMENTS AND DATA ANALYSIS IN PLASTICS ENGINEERING
1968 59 p refs Presented at the PAG Tech. Conf., Chicago, 19–20 Sep. 1968
Avail: Issuing Activity

CONTENTS:

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3. FLOW PROPERTIES OF PLASTICIZED PVC: REDUCTION TO COMPOSITION AND INTERACTION VARIABLES H. P. Schreiber (Canadian Industries, Ltd.) p 19–23 refs (See N69-18160 07-06)

4. SOME STUDIES OF PROPERTIES OF PLASTIC AT BELL TELEPHONE LABORATORIES (Bell Tele. Labs., Inc.) p 24–41 (See N69-18161 07-18)

5. ASPECT OF ULTIMATE PROPERTIES: MECHANICAL FATIGUE G. P. Koo (Allied Chemical Corp.) p 43–50 refs (See N69-18162 07-18)

N69-18159# Monsanto Co., Texas City, Tex.
FLOW PROPERTIES OF POLYMER MELTS
Robert A. Mendelson *In* Soc. of Plastics Engr., Inc. Design of Expt. and Data Analysis in Plastics Eng. 1968 p 7–18 refs (See N69-18157 07-18)
Avail: Issuing Activity

A series of experiments are described which provide a very general technique for predicting polyethylene flow behavior as a function of shear rate over a wide range of temperatures from a minimum of new data. In this case the experimentation was concerned only with the viscous aspect of flow and was not limited by the availability of special samples. The second experimental program studied involved the quantitative determination of the effect of long chain branching in low density polyethylene on melt viscosity and melt elasticity, independent of the effects of other molecular variables. This required the polymerization of special samples followed by detailed characterization by both solution property and melt rheological techniques. B.P.

N69-18161# Bell Telephone Labs., Inc., New York.
SOME STUDIES OF PROPERTIES OF PLASTICS AT BELL TELEPHONE LABORATORIES
In Soc. of Plastics Engr., Inc. Design of Expt. and Data Analysis in Plastics Eng. 1968 p 24–41 (See N69-18157 07-18)
Avail: Issuing Activity

Brief descriptions are given of some of the work at Bell Laboratories on the nature and properties of plastics. Aspects of relationship between structure and properties of plastics are studied. Studies of creep in acrylonitrile-butadiene-styrene (ABS) polymers were undertaken at a series of temperatures at which the acrylonitrile-styrene matrix exhibits glassy responses. Dynamic mechanical testing is discussed and its usefulness is illustrated in understanding macroscopic mechanical properties in terms of polymer microstructures. Calorimetric information is reported on semicrystalline and glassy plastics. The load bearing ability of adhesive joints was studied in a humid environment at moderately high temperatures. The viscous and elastic flow behavior of polymer melts are studied in relation to their implications on processing. Gel permeation chromatography was used to determine the molecular weight polydispersity in polymers. B.P.

N69-18162# Allied Chemical Corp., Morristown, N. J. Plastics Div.
ASPECT OF ULTIMATE PROPERTIES: MECHANICAL FATIGUE
George P. Koo *In* Soc. of Plastics Engr., Inc. Design of Expt. and Data Analysis in Plastics Eng. 1968 p 43–50 refs (See N69-18157 07-18)
Avail: Issuing Activity

General aspects of fatigue testing are described. The effects of hysteretic heating of a polymer during cyclic loading is considered. A linear viscoelastic model is constructed under dynamic loading conditions. The microscopic examination of polytetrafluoroethylene suggested that the weakening and failure of polymer samples under cyclic load appeared to correspond to the destruction of regions of crystalline order due to the combined effects of external stress and internal friction. B.P.

N69-18190# Technische Hochschule Munchen (West Germany). Institut fuer Radiochemia.
INVESTIGATION OF γ-RADIOLYSIS OF POLYSTYRENE [UNTERSUCHUNGEN ZUR γ-RADIOLYSE VON POLYSTYROL]
H. Heusinger and J. Wilske Jul. 1968 34 p refs In GERMAN; ENGLISH summary
(MBwF-FBK-68-31) Avail: CFSTI

For polystyrene samples, which contained pyrene in various concentrations, the G-values of radical formation, hydrogen production, and crosslinking were determined for γ-irradiation at room temperature. By addition of pyrene, the radical formation in polystyrene decreased rapidly, while hydrogen production and crosslinking were nearly unaffected. It could be shown that the formation of radicals, which can be detected by ESR spectroscopy after irradiation, starts from the first excited singlet state of polystyrene and competes with radiationless energy transfer to pyrene molecules. Hydrogen production and crosslinking are independent of the formation of these radicals and should be due to ion–molecule reactions or reactions of hot hydrogen atoms. The results indicate that in addition to energy transfer from polystyrene to pyrene by dipole–dipole interaction, intramolecular energy transfer within polystyrene molecules takes place, too. Author (NSA)

N69-18286*# Washington Univ., Seattle. Ceramic Engineering Div.
MULTIDISCIPLINARY RESEARCH ACTIVITY ON THE NATURE AND PROPERTIES OF CERAMIC MATERIALS Semiannual Status Report, Jun. 16–Dec. 15, 1968
James I. Mueller Dec. 1968 41 p refs
(GRANT NGL-48-002-004)
(NASA-CR-99763; SASR-11) Avail: CFSTI CSCL 11B

Thirty-two projects were supervised by nineteen faculty members in eight academic disciplines of the University during this reporting period. The effects of chemical environment on ceramics were studied and included research in the areas of gas–solid and solid–solid equilibrium, bonding in interstitial compounds, zirconium oxidation, and calorimetry studies. The mechanical properties and interfacial energies of aluminum oxide bicrystals were determined. Bond strengths of ZrC coatings were studied. The defect properties of ionic and ceramic crystals were characterized. Stresses were evaluated in polycrystalline ceramics. Research on the electronic properties and radiation effects of ceramics is summarized. Processing and fabricating ceramics are reviewed. The characteristics of ceramics as modelling materials for antenna systems were studied. B.P.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-17229# National Bureau of Standards, Washington, D. C.
SOME QUESTIONS ON THE HISTORY OF THE THEORY OF ERRORS
O. B. Sheinin 1968 14 p refs Transl. into ENGLISH from Nekotoryye Vopr. Istorii Teorii Oshibok (Moscow), 1967
(PB-180238) Avail: CFSTI CSCL 12A

The paper describes the author's dissertation. The work contains three chapters, an appendix, and an addendum. In Chapter I is investigated the early application of the arithmetic mean in approximate calculations, in games of chance, in astronomy and in the theory of probability proper. In Chapter II, the works of Galileo and Lambert have been studied, in connection with the history of the treatment of direct measurements. In Chapter III the history of the mathematical treatment of indirect measurements is studied. USGRDR

N69-17249*# Clemson Coll., S. C.
A FAMILY OF SOLUTIONS OF CERTAIN NONAUTONOMOUS DIFFERENTIAL EQUATIONS BY SERIES OF EXPONENTIAL FUNCTIONS
T. G. Proctor and H. H. Suber Washington NASA Feb. 1969 26 p refs
(Grant NGR-41-001-016)
(NASA-CR-1294) Avail: CFSTI CSCL 12A

Construction theorems are presented for the solutions of certain nonautonomous differential equations. Exponential series solutions are given for a family of periodic solutions of a Ricatti equation with odd periodic coefficients and finite Fourier series expansion. This result is generalized to the existence of a first order quasi-periodic vector differential equation which is odd in the independent variable. Applications are included. Author

N69-17255 California Univ., Berkeley.
ABSTRACT SYSTEMS WITH THE DECOMPOSITION PROPERTY
Keith Lonnie Doty (Ph.D. Thesis) 1967 129 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-10308

By definition, all linear systems have the decomposition property, but the converse is not true. This paper is an investigation into the general form exhibited by discrete-time and continuous-time systems with decomposition and the implications of this property with regard to the important concepts of system equivalence, finite memory, information losslessness, linearity, and invertibility. An efficient algorithm is developed by which an arbitrary complete sequential machine may be tested for decomposition. The concepts of inverse and left inverse systems are defined and examined. It is also shown that the behavior of the subsystem consisting of all states accessible from a linear zero state is linear. An application of this theorem to finite state systems is given. Dissert. Abstr.

N69-17297# Institut Franco-Allemand de Recherches, St. Louis (France).
NUMERICAL TABLES OF THE STUDENT, OR THE T-DISTRIBUTION [TAFELN DER STUDENT- ODER T-VERTEILUNG]
R. Laumann 17 Oct. 1967 53 p In GERMAN
(ISL-N-21/67) Avail: CFSTI

Calculated was the t-distribution for 25 degrees of freedom in the region of 20 to 1000 and for $0 \leq t \leq 4$ at a step width of 0.01 and 7 valid digits. The FORTRAN program used and obtained data tables are presented. G.G.

N69-17302*# Auburn Univ., Ala. Advanced Studies Group.
SEVERAL METHODS FOR DIGITAL SIMULATION OF PHYSICAL SYSTEMS
J. L. Lowry Feb. 1968 84 p refs
(Contract NAS8-20004)
(NASA-CR-98280)Avail: CFSTI CSCL 12A

A number of methods which are suitable for digitally simulating physical systems are presented in detail. A brief discussion of the error involved in each method is presented along with the method derivation. Each class of methods is illustrated with one or more solved examples, and the computer results are given in tabular and graphic forms. The approximations, restrictions, and limitations for each class of methods are presented along with that class. Author

N69-17349# Wisconsin Univ., Madison. Mathematics Research Center.
A COMBINATORIAL PROBLEM ON FINITE ABELIAN GROUPS Technical Summary Report
John E. Olson Aug. 1968 15 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679929; MRC-TSR-926) Avail: CFSTI CSCL 12/1

Several theorems of a combinatorial nature are proved concerning the set of all products (g sub i sub 1)(g sub i sub 2)...(g sub i sub t) (1 = or < i sub 1 < ... < i sub t = or < k) where g sub 1, g sub 2,..., g sub k is an arbitrary sequence of elements from a finite Abelian group. Author (TAB)

N69-17357*# Georgia Univ., Athens.
CURTAILED ATTRIBUTE SAMPLING
A. Clifford Cohen Huntsville, Ala. NASA, Marshall Space Flight Center Jan. 1969 13 p refs
(Contract NAS8-1117E)
(NASA-CR-61255) Avail: CFSTI CSCL 12A

This paper is concerned with maximum likelihood estimation (MLE) of a process (or lot) average proportion of defectives based on attribute samples that have been curtailed either with rejection of a lot on finding the kth defective or with acceptance on finding the Kth nondefective. The MLE based on inspections from a sequence of m lots, is shown to be simply the ratio of the number of defectives found to the total number of items inspected, and the asymptotic variance of this estimator is shown. Author

N69-17381# Wisconsin Univ., Madison. Mathematics Research Center.
HYPOTHESIS TESTING AND CONFIDENCE INTERVALS FOR PRODUCTS AND QUOTIENTS OF POISSON PARAMETERS WITH APPLICATIONS TO RELIABILITY
Bernard Harris Aug. 1968 17 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679925; MRC-TSR-923) Avail: CFSTI CSCL 12/1

Confidence intervals and tests of hypotheses for the parameter theta = (lambda sub 1)(lambda sub 2)...(lambda sub k sub 1)/(mu sub 1)(mu sub 2)...(mu sub k sub 2) are obtained, where lambda sub i, mu sub i are Poisson paramaters. This problem is of importance in reliability analysis. Author (TAB)

N69-17381 California Univ., Berkeley.
FUZZY SETS AND PATTERN RECOGNITION
Chin-Liang Chang (Ph.D. Thesis) 1967 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10297

A fuzzy set is characterized by a membership function which assigns to each object a grade of membership ranging between zero and one. An m-valent fuzzy set is characterized by a membership function which takes values in $[0,1]^m$ Various properties of fuzzy sets and m-valent fuzzy sets are established. Their applications to pattern recognition problems are investigated. Viewed in the context of fuzzy sets, the problem of pattern recognition may be regarded as that of estimating the membership function of a fuzzy set from the knowledge of the membership grades which it assigns to a finite set of objects. Relevant to this problem are various separation properties of fuzzy sets, in particular linear separability by means of hyperplanes. Dissert. Abstr.

N69-17386 California Univ., Berkeley.
A COMPLETENESS THEOREM AND A COMPUTER PROGRAM FOR FINDING THEOREMS DERIVABLE FROM GIVEN AXIOMS
Char-Tung Lee (Ph.D. Thesis) 1967 59 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10359

This thesis is concerned with the problem of finding interesting theorems derivable from a set of axioms. The author used an inference rule, called the resolution principle, and proved the completeness of the resolution principle for finding theorems. The logical basis for this program is the first order predicate calculus. The input to the program is a set of axioms in the form of a conjunction of clauses. Every theorem deduced by this program is also in the form of a clause. The paper defines the triviality of a theorem, a theorem that is implied by another theorem. The various versions of the program are PG1, PG2,...PG6 respectively. PG5 is the best version; it employs the unit resolution principle, the sub-clause principle, the unit condensation procedure as well as the axiom resolution strategy. The program proved 41 of 45 theorems selected from Lederman's book on group theory. Dissert. Abstr.

N69-17396*# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
THE THEORY OF EXCEEDANCES
N. E. Rich Jun. 1968 61 p
(Contract NAS8-20082)
(NASA-CR-61254; LMSC/HREC-A791583) Avail: CFSTI CSCL 12A

In this document the probability that the mth largest of the past L observations will be exceeded k times in N future trials is derived. The expected number of exceedances and the variance are also found. An interpolative scheme is presented for defining probabilities associated with values not actually observed. The EDNE computer program, which calculates the probabilities of exceedances and plots the interpolative solution, is discussed. A user's manual and listing of this program is also included. Several asymptotic distributions for large future sample sizes are developed. Author

N69-17400# Wisconsin Univ., Madison. Mathematics Research Center.
SOME NEW GENERALIZED INVERSES WITH SPECTRAL PROPERTIES Technical Summary Report
T. N. E. Greville Apr. 1968 25 p refs Presented at the Symp. on Theory and Appl. of Generalized Inverses of Matrices, Lubbock, Tex., 7-8 Mar. 1968
(Contract DA-31-124-ARO(D)-462)
(AD-679932; MRC-TSR-867) Avail: CFSTI CSCL 12/1

Some matrix generalized inverses with spectral properties are studied, including one having least-square properties as well, and another having the property that the inverse of the inverse is the original matrix. Author (TAB)

N69-17407# Woods Hole Oceanographic Institution, Mass.
ONE DIMENSIONAL INTERPOLATION WITH A TEST FORTRAN PROGRAM Final Technical Report
Robert R. Brockhurst Aug. 1968 28 p refs
(Nonr-4730(00))
(AD-679937; WHOI-REF-68-54) Avail: CFSTI CSCL 12/1

The interpolation method described here produces a continuous curve with a continuous first derivative through an arbitrary set of points, ordered according to the dependent variable and single valued. Its use is recommended when the specific functional relation is unknown and when the areas of uncertainty of the points are small compared to their separation so that a least-squares fit is not desirable. Author (TAB)

N69-17414# Wisconsin Univ., Madison. Mathematics Research Center.
SOLUTION OF ABSTRACT POLYNOMIAL EQUATIONS BY ITERATIVE METHODS Technical Summary Report
Louis B. Rall Aug. 1968 40 p
(Contract DA-31-124-ARO(D)-462)
(AD-679933; MRC-TSR-892) Avail: CFSTI CSCL 12/1

Simple computational methods are given for solving a large class of nonlinear equations of polynomial type. Author (TAB)

N69-17415# Wisconsin Univ., Madison. Mathematics Research Center.
APPLICATIONS OF ϵ-ENTROPY TO THE COMPUTATION OF n-WIDTHS Technical Summary Report
J. W. Jerome and L. L. Schumaker Aug. 1968 19 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679934; MRC-TSR-928) Avail: CFSTI CSCL 12/1

An implicit relationship between n-width and entropy inherent in certain negative Vituskin type results for non-linear approximation is used to compute n-widths of some classes of smooth functions. Author (TAB)

N69-17419# Wisconsin Univ., Madison. Mathematics Research Center.
SOLUTION OF LINEAR INTEGRAL EQUATIONS BY THE USE OF INVARIANT FUNCTIONS Technical Summary Report
Louis B. Rall Oct. 1968 17 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679930; MRC-TSR-945) Avail: CFSTI CSCL 12/1

A simple method is presented for the solution of linear integral equations. The relationship of this method to the replacement of an integral equation by an infinite system of equations and to the solution of integral equations by the use of characteristic functions (eigenfunctions) is shown, and its application is illustrated by a simple example. Author (TAB)

N69-17420 Washington Univ., Seattle.
THE APPLICATION OF TRAINABLE PATTERN CLASSIFIERS TO THE CURVE-FITTING PROBLEM
Gordon Henry Syms (Ph.D. Thesis) 1967 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-9341

Research on the development of an adaptive pattern classifier and the experimental results of applying these techniques to the curve fitting problem. The problem involves determining the best fitting curve coefficients from a set of data points. Additional theory was developed for general pattern classifiers. These include the condition for one step correction under various training methods and the development of a modified Euclidean metric. The one step correction method enhances the rate of learning while the modified Euclidean metric is used to produce variable sized categories. Two adaptive pattern classifiers were designed to solve practical scientific problems. The new methods for the curve fitting model include a method for assigning curve coefficients to modified category vectors, a method for deleting old categories when a new category is required and several methods for adjusting the threshold (or rejection criterion) during learning. In addition to the curve fitting model, an advanced model with many heuristics was developed for general pattern classification problems. It was demonstrated that pattern classification techniques can be employed successfully on the curve fitting problem. Dissert. Abstr.

N69-17449# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
SOME INTEGRAL EQUATIONS RELATED TO ABEL'S EQUATION AND THE HILBERT TRANSFORM
A. S. Peters Nov. 1968 39 p refs
(Contract NONR-285(55))
(AD-679702; IMM-373; NR-062-160) Avail: CFSTI CSCL 12/1

The report is concerned with the inversion of a generalization of the Hilbert transform. Author (TAB)

N69-17454# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
UNIFORMLY MINIMUM VARIANCE UNBIASED ESTIMATORS WHEN THE PROBABILITY DISTRIBUTIONS HAVE A FINITE RANK
Kei Takeuchi Oct. 1968 29 p refs
(Contract N00014-67-A-0467)
(AD-679622; IMM-372) Avail: CFSTI CSCL 12/1

The structure of the class of uniformly minimum variance unbiased estimators was discussed almost completely by R. R. Bahadur. Here we shall discuss the simple case when the class of probability distributions has only a finite number of linearly independent ones. Then it can be shown by elementary methods that an estimator is UMV if and only if it is measurable with respect to some finite field L. Necessary and sufficient conditions for a set A belong to L are obtained. The multinomial case is discussed. Author (TAB)

N69-17462# Wisconsin Univ., Madison. Mathematics Research Center.
MAXIMUM LIKELIHOOD ESTIMATION OF MULTIVARIATE COVARIANCE COMPONENTS FOR THE BALANCED ONE WAY LAYOUT Technical Summary Report
Jerome Klotz and Joseph Putter Jul. 1968 14 p refs
(Contract DA-31-124-ARO(D)-462; Grant AF-AFOSR-1158-66)
(AD-679931; MRC-TSR-909) Avail: CFSTI CSCL 12/1

Multivariate maximum likelihood estimators are defined and derived for the p-variate balanced one way layout components of variance and covariance model. The solution involves generalized inverses and functions of matrices and does not take on inadmissible values as does the commonly used unbiased estimator. Author (TAB)

N69-17463# Wisconsin Univ., Madison. Mathematics Research Center.
A CHARACTERIZATION OF FUNCTIONS WITH HIGHER ORDER DERIVATIVES IN L SUB p Technical Summary Report
J. W. Jerome and L. L. Schumaker Jun. 1968 16 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679935; MRC-TSR-905) Avail: CFSTI CSCL 12/1

A characterization in terms of sums of m(th) order divided differences is given for functions with absolutely continuous (m-1)st derivatives and m(th) derivatives in L sub p(a,b), -infinity = or < a < b = or < infinity. Author (TAB)

N69-17474# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE REALIZATION OF STOCHASTIC PROCESSES BY PROBABILITY DISTRIBUTIONS IN FUNCTION SPACES II
V. Mandrekar and Henry B. Mann Jul. 1968 11 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679481; MRC-TSR-913) Avail: CFSTI CSCL 12/1

A function psi(t) is called denumerably lower continuous (dlc) if it is continuous on a dense denumerable set t sub 1, t sub 2,... and if for all t psi(t) = lim as t sub alpha approaches t of (inf psi(t sub alpha)). It is shown that every process which is almost certainly connected can be realized in the space of dlc functions. Author (TAB)

N69-17476# RAND Corp., Santa Monica, Calif.
SEMI-MARKOV PROCESSES: A PRIMER
Bennett Fox Nov. 1968 45 p refs
(Contract F44620-67-C-0045)
(AD-679584; RM-5803-PR) Avail: CFSTI CSCL 12/2

Marrying renewal processes and Markov chains yields semi-Markov processes; the former are special cases of the latter. This expository Memorandum outlines some of the main properties of the union. Author (TAB)

N69-17479# Wisconsin Univ., Madison. Mathematics Research Center.
MATHEMATICAL PROGRAMMING IN PARTIALLY ORDERED BANACH SPACES
K. Ritter Feb. 1968 47 p refs
Contract DA-31-124-ARO(D)-462)
(AD-679493; MRC-TSR-851) Avail: CFSTI CSCL 12/2

The purpose of this paper is to derive several necessary and sufficient conditions for the optimal solution of a mathematical programming problem in partially ordered Banach spaces. It is assumed that the objective function of this problem is defined by a nonlinear operator and its feasible domain is determined by a finite number of operator equations and inequalities as well as the restriction of the variable to an arbitrary convex set. Author (TAB)

N69-17494# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE MINIMIZATION OF FUNCTIONS OF MANY-VALUED LOGIC
Ya. Kh. Adzhi-Veli 26 Jan. 1968 12 p refs Transl. into ENGLISH from Akad. Nauk UzSSR. Izv. Ser. Tekh. Nauk (USSR), no. 4, 1966 p 16-22
(AD-679714; FTD-HT-23-1349-67) Avail: CFSTI CSCL 9/2

The article is devoted to formulating the problem of the minimization of the logical functions of many-valued logic: constants, characteristic functions, disjunction, conjunction and inversion. Author (TAB)

N69-17804# Oak Ridge National Lab., Tenn. Mathematics Div.
A GENERALIZED MULTI-DIMENSIONAL AGE-DEPENDENT BRANCHING PROCESS

Charles J. Mode Nov. 1968 51 p refs
(Contract W-7405-ENG-26)
(ORNL-4331) Avail: CFSTI

In the classical age-dependent branching process of Bellman and Harris the death and the production of off-spring by an individual coincide. For many biological applications, however, it is necessary to consider a model in which an individual may give birth to offspring at random points of time during his life-span. A generalized multidimensional age-dependent branching process is a stochastic model for the growth of a population of particles (individuals) which may produce new individuals (particles) at random points during their life-span and each individual may belong to one of a finite number of types. Such processes have applications in both biology and physics. Applications of the process to the dynamics of cell populations and population genetics are included.
Author (NSA)

N69-17519 Illinois Univ., Urbana.
THE SPECIFICATION AND SAMPLING PROPERTIES OF CLASSICAL AND BAYESIAN TRANSITION PROBABILITY ESTIMATORS
Tsoung-chao Lee (Ph.D. Thesis) 1967 245 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.20 Order No. 68-8145

Some efficient methods of estimating transition probabilities are explored when only the aggregated proportion data are available. The distribution properties of the estimators are investigated by a Monte Carlo experiment. In particular, the Weighted Restricted Least Squares (WRLS), the Minimum Absolute Deviation (MAD), the Generalized Least Squares (GLS), the Minimum Chi-Squares (MCS), the Maximum Likelihood (ML) and the Bayesian estimators are formulated. Without considering the probability restrictions, the efficient estimators are the ML and the Bayesian estimators. The sampling study based on a Monte Carlo experiment is performed for all the alternative estimators formulated. The results indicate that each of these estimators provides a satisfactory basis for estimating transition probabilities from proportion data generated from a stationary Markov chain. The alternative criteria employed in making comparisons among alternative estimators suggest the following ranking: Bayesian, ML, WRLS, unweighted RLS, MAD and unrestricted least squares.
Dissert. Abstr.

N69-17543# RAND Corp., Santa Monica, Calif.
INVARIANT IMBEDDING AND THE VARIATIONAL TREATMENT OF FREDHOLM INTEGRAL EQUATIONS WITH DISPLACEMENT KERNELS
J. Casti, R. Kalaba, and S. Ueno Nov. 1968 18 p refs
(Contract F44620-67-C-0045)
(AD-679546; RM-5831-PR) Avail: CFSTI CSCL 12/1

The report describes a new and computationally efficient method of solving Fredholm integral equations with displacement kernels, such as those arising in radiative transfer and optimal filtering theory. Frequently, studies of these equations are based on the fact that their solutions minimize certain quadratic functionals, which opens the way to the employment of the Rayleigh-Ritz method. The aim of the present study is radically different: It is shown that the minimizer of the quadratic functional satisfies a Cauchy problem. The numerical integration of the initial-value problem is carried out by replacing the integrals by finite sums using gaussian quadrature formulas. This reduces the differential-integral equations to a system of ordinary differential equations.
Author (TAB)

N69-17544# Wisconsin Univ., Madison. Mathematics Research Center.
ON SECOND ORDER NONLINEAR OSCILLATION
James S. W. Wong Jan. 1968 55 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679484; MRC-TSR-836) Avail: CFSTI CSCL 12/1

Theorems on second order nonlinear oscillation are given together with a comprehensive survey on current literature.
Author (TAB)

N69-17545# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE CONVERGENCE OF FINITE-DIFFERENCE APPROXIMATIONS TO ONE-DIMENSIONAL SINGULAR BOUNDARY-VALUE PROBLEMS
Pierre Jamet Jul. 1968 44 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679478; MRC-TSR-899) Avail: CFSTI CSCL 12/1

Consider a linear ordinary differential equation of the 2nd order which has a singularity at the origin; according to the nature of this singularity we must consider either the two-point boundary-value problem or the one-point boundary-value problem. Finite-difference schemes are studied; results are given concerning error analysis and monotone convergence.
Author (TAB)

N69-17551# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE USE OF SPLINE FUNCTIONS FOR THE NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS
Frank R. Loscalzo May 1968 113 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679479; MRC-TSR-869) Avail: CFSTI CSCL 12/1

Spline functions are used to obtain global approximations to solutions of first order differential equations with given initial values. A class of methods based on Hermite's quadrature formula of 1878 is examined in detail.
Author (TAB

N69-17552# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Deputy for Engineering.
AN ALGORITHM FOR DETERMINING THE LARGEST MAXIMALLY INDEPENDENT SET OF VECTORS FROM AN R-DIMENSIONAL VECTOR SPACE OVER A GALOIS FIELD OF N ELEMENTS Technical Report, Dec. 1965–Apr. 1968
Robert R. Jurick Sep. 1968 102 p refs
(AD-679543; ASD-TR-68-40) Avail: CFSTI CSCL 12/1

The report expands upon a paper (1) presented by Robert Silverman and Carl Manari in the Journal of Algebra, November 1966. Two problems will be considered: a vector space packing problem, and its combinatorial generalization as a partitioning problem. The vector space packing is equivalent to finding the largest number of vectors of an r-dimensional vector space such that any r of them form a basis for the space. Other interesting equivalent formulation of these problems will be described in Section 1.2. The above paper (1) presented complete results for the first problem for Galois fields of up to eight elements. This report will give complete results for the first problem for Galois fields of up to eleven elements and partial results for fields up to thirteen elements. The major contribution of this report, however, is not the results; it is the systematic method used in obtaining these results, that is, an algorithm. Although the results for larger fields were not obtained because of the excessive computer time needed to determine them, the algorithm presented here is not limited by computer constraints, and, therefore, as faster computers are built, this algorithm will be able to generate results for larger and larger fields.
Author (TAB)

N69-17568# Wisconsin Univ., Madison. Mathematics Research Center.
GREEN'S FUNCTIONS ON THE CLASSICAL CARTAN DOMAINS
K. T. Hahn and Josephine Mitchell Sep. 1967 28 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679488; MRC-TSR-800) Avail: CFSTI CSCL 12/1

Green's functions are obtained for the invariant Laplace equation on the classical Cartan domains R sub j (j = I, ... IV) which are related to the Poisson kernel of these domains.
Author (TAB)

N69-17569# Wisconsin Univ., Madison. Mathematics Research Center.
A WEIERSTRASS THEOREM FOR REAL SEPARABLE HILBERT SPACES
P. M. Prenter Apr. 1968 22 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679485; MRC-TSR-868) Avail: CFSTI CSCL 12/1

A Weierstrass Theorem is proved in a real, separable Hilbert space where polynomials Px = L sub 0 + (L sub 1)x + ... + (L sub n)x to the nth power are sums of k-linear operators.
Author (TAB)

N69-17575# Wisconsin Univ., Madison. Mathematics Research Center.
THE QUESTION OF UNIQUENESS FOR G. D. BIRKHOFF INTERPOLATION PROBLEMS
David Ferguson Mar. 1968 51 p refs
(Contract DA-31-124-ARO-D-462)
(AD-679494; MRC-TSR-861) Avail: CFSTI CSCL 12/1

A complete characterization is given for polynomial interpolation problems of the type studied by G. D. Birkoff which always yield unique solutions.
Author (TAB)

N69-17579# RAND Corp., Santa Monica, Calif.
BLOCKING POLYHEDRA
D. R. Fulkerson Dec. 1968 34 p refs
Contract F44620-67-C-0045)
(AD-679986; RM-5834-PR) Avail: CFSTI CSCL 12/1

A geometric theory of blocking polyhedra is developed and applied to a number of problems in extremal combinatorics. The basic notion is a variant of the concept of polar polyhedra and exhibits a similar duality. The max-flow min-cut equality and the length-width inequality, valid for paths and cuts in a network, always hold for a blocking pair of polyhedra, and the former of these characterizes the blocking relation. A typical combinatorial application is a new geometric characterization of the permutation matrices as the extreme points of a certain unbounded convex polyhedron.
Author (TAB)

N69-17596# Wisconsin Univ., Madison. Mathematics Research Center.
QUASI-DIFFERENTIAL OPERATIONS IN HILBERT SPACE
A. Zettl Feb. 1968 30 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679489; MRC-TSR-854) Avail: CFSTI CSCL 12/1

A characterization of self-adjoint extensions of symmetric differential operators in L superscript 2, defined in terms of very general quasi-differential expressions, is obtained.
Author (TAB)

N69-17605# Wisconsin Univ., Madison. Mathematics Research Center.
A SHORT CUT IN THE DECOMPOSITION ALGORITHM FOR SHORTEST PATHS IN A NETWORK
T. C. Hu and W. T. Torres Jul. 1968 15 p ref
(Contract DA-31-124-ARO(D)-462)
(AD-679936; MRC-TSR-882) Avail: CFSTI CSCL 12/2

A new decomposition algorithm is presented for determining the shortest paths between all pairs of nodes in a network.
Author (TAB)

N69-17606# Iowa State Univ. of Science and Technology, Ames.
SIZE AND POWER OF SOME TESTS UNDER EXPERIMENTAL RANDOMIZATION Interim Technical Scientific Report
Thomas E. Doerfler Wright-Patterson AFB, Ohio ARL Sep. 1968 115 p refs
(Contract AF 33(615)-1737)
(AD-680007; ARL-68-0179) Avail: CFSTI CSCL 12/1

This report deals with an investigation of the behavior of competitive tests for the paired design under experiment randomization. The tests considered are the Fisher randomization test (R), the Wilcoxon paired test (W), the Sign test (S), and the normal law F test (F). The paired design with N pairs results in the drawing at random of one of 2 to the Nth power possible plans and the performance of the tests in this population of repetitions is considered. Theoretical and Monte Carlo results are presented. The general conclusion is that the R and W tests are definitely superior to the other two tests. The R test is slightly superior to the W test in having a greater number of possible significance levels, but at sizes of test possible with both, the powers of the two tests are very close. The relationship of the results to asymptotic theory is discussed.
Author (TAB)

N69-17616# Wisconsin Univ., Madison. Mathematics Research Center.
THE VALUE OF PRIOR INFORMATION Technical Summary Report
Norman R. Draper Jan. 1968 33 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679928; MRC-TSR-841) Avail: CFSTI CSCL 12/1

A natural question that arises in Bayesian statistics, is how inference might be affected by a change in the prior distribution, i.e., by the availability of more or less information on the parameters of the assumed model. A criterion for evaluating this is suggested and used to compare the value of prior information, when sampling is from the normal, negative binomial, poisson and exponential distributions.
Author (TAB)

N69-17671# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematics.
SYSTEMS OF NATURAL DISTRUCTION WITHOUT ESSENTIAL RESTRICTIONS ON VARIABLES
Kurt Bing 25 Nov. 1968 9 p refs
(Contract F44620-67-C-0014)
(AD-679600; RPI-MATH-84) Avail: CFSTI CSCL 12/1

Research is summarized on the construction of a linear system in which the usually cumbersome quantifier rules are replaced by simpler ones. In it, the notion of a deduction is primitive, deducibility being the existence of a suitable deduction. A deduction is conceived as a finite sequence of formulas in which every formula appears with its number and with the set of assumption formulas on which it depends. No variables are flagged. The rules of the linear system are designed to make it correspond to the process of intuitive linear reasoning. The system is complete as to logical consequence and admits the positive, minimal, and intuitionistic subsystems.
Author (TAB)

N69-17694# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE ASYMPTOTIC SOLUTION OF MULTI-POINT BOUNDARY VALUE PROBLEMS
R. E. O'Malley, Jr. Jul. 1968 21 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679498; MRC-TSR-885) Avail: CFSTI CSCL 12/1

The paper analyzes certain multi-point boundary value problems for linear ordinary differential equations which depend on a small, positive parameter epsilon. The differential order of both the equation and the boundary conditions are allowed to drop when epsilon = 0. Conditions are obtained to guarantee convergence to a limiting solution as epsilon approaches zero, and complete asymptotic expansions are then given.
Author (TAB)

N69-17708# Wisconsin Univ., Madison. Mathematics Research Center.
A STRONG LAW OF LARGE NUMBERS FOR WEAKLY ORTHOGONAL SEQUENCES OF BANACH-SPACE VALUED RANDOM VARIABLES
Anatole Beck and Peter Warren Feb. 1968 46 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679492; MRC-TSR-848) Avail: CFSTI CSCL 12/1

A generalization of the Strong Law of Large Numbers to weakly orthogonal sequences of Banach-Space valued random variables is given. Author (TAB)

N69-17716# Wisconsin Univ., Madison. Mathematics Research Center.
SPLINE INTERPOLATION AND THE HIGHER DERIVATIVES
I. J. Schoenberg Jul. 1967 23 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679495; MRC-TSR-761) Avail: CFSTI CSCL 12/1

A result of F. Riesz is generalized leading to a characterization of those functions of one real variable which have a square integrable mth derivative. The theory of spline interpolation is the main tool in this investigation. Author (TAB)

N69-17762# Washington Univ., Seattle. Dept. of Mathematics.
INTERSECTION THEOREMS FOR POSITIVE SETS
Wolfhard Hansen and Victor Klee Dec. 1968 12 p refs
(Contract N00014-67-A-0103)
(AD-679912; TR-11) Avail: CFSTI CSCL 12/1

The shortest proof of Hellys intersection theorem, due to Radon, is based on the fact that a subset of R(superscript d) is affinely independent if and only if it does not contain disjoint sets whose convex hulls intersect. Here a similar approach leads to short proofs of old and new intersection theorems for positive sets (convex cones with apex at the origin). The basic tool is a characterization and classification of subsets X of R(superscript d) that are strongly positively independent. Author (TAB)

N69-17797# Philco-Ford Corp., Blue Bell, Pa. Advanced Engineering and Research Lab.
ADAPTIVE MODELLING OF LIKELIHOOD CLASSIFICATION—2 Final Report, 4 Apr. 1966–23 Nov. 1967
Kenneth Abend, Thomas J. Harley, Jr., and Laveen N. Kanal Griffiss AFB, N. Y. RADC Oct. 1968 210 p refs
(Contract AF 30(602)-3623)
(AD-678923; B008-2; RADC-TR-68-118) Avail: CFSTI CSCL 9/4

The report is largely devoted to compound decision procedures and their application to pattern classification; applications presented include taking context into account, the combatting of intersymbol interference adaptive threshold adjustment, and the classification of non-stationary time series. A multivariate, two-sample, rank-order classification procedure is described. The characterization of the complexity of pattern recognition problems and recognition systems is considered. Computer experiments, comparing a self-adjusting threshold procedure with a Bayesian procedure, are also presented. Author (TAB)

N69-17802# Wisconsin Univ., Madison. Mathematics Research Center.
CARDINAL INTERPOLATION AND SPLINE FUNCTIONS
I. J. Schoenberg Feb. 1968 71 p refs
(Contract DA-31-124-ARO-D-462)
(AD-679482; MRC-TSR-852) Avail: CFSTI CSCL 12/1

The purpose of the present paper is to show that the spline interpolation methods introduced by the author in Quarterly of Applied Math. 4 (1946), 45-99 and 112-141, easily furnish the results of Subbotin, Proc. Steklov Institute of Math., 78 (1965), 24-42, and go way beyond them. Author (TAB)

N69-17803# Wisconsin Univ., Madison. Mathematics Research Center.
THE NUMERICAL SOLUTION OF VOLTERRA INTEGRAL EQUATIONS BY FINITE DIFFERENCE METHODS
Peter Linz Nov. 1967 97 p refs
(Contract DA-31-124-ARO-D-462)
(AD-679483; MRC-TSR-825) Avail: CFSTI CSCL 12/1

Theoretical and practical aspects of numerical methods for solving Volterra integral equations of the first and second kinds are studied. Author (TAB)

N69-17804# Wisconsin Univ., Madison. Mathematics Research Center.
SOLUTION OF DUAL TRIGONOMETRICAL SERIES USING ORTHOGONALITY RELATIONS
Ben Noble and John Whiteman Aug. 1968 16 p refs
(Contract DA-31-124-ARO-D-462)
(AD-679486; MRC-TSR-890) Avail: CFSTI CSCL 12/1

The unknown coefficients in dual trigonometrical series are found by a method which eliminates the need for assuming initially the forms of the expressions for the coefficients, and also for differentiating the original series term by term. The expressions produced for these coefficients are in certain cases simpler than those known previously. Author (TAB)

N69-17805# Wisconsin Univ., Madison. Mathematics Research Center.
SOME REMARKS ON HERMITIAN AND ANTI-HERMITIAN PROPERTIES OF GREEN MATRICES
James S. W. Wong May 1968 16 p refs
(Contract DA-31-124-ARO-D-462)
(AD-679480; MRC-TSR-878) Avail: CFSTI CSCL 12/1

Necessary and sufficient conditions for certain two-point boundary value problems with functions of bounded variation as solutions to have symmetric Greens matrices are given. Author (TAB)

N69-17825# Wisconsin Univ., Madison. Mathematics Research Center.
ON Lg-SPLINES Technical Summary Report
J. W. Jerome and L. L. Schumaker Jul. 1968 37 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679927; MRC-TSR-887) Avail: CFSTI CSCL 12/1

Spline functions associated with a general linear differential operator L which interpolate prescribed data with respect to arbitrary linear functionals are investigated. Author (TAB)

N69-17826# RAND Corp., Santa Monica, Calif.
VALUES OF NON-ATOMIC GAMES. PART 1: THE AXIOMATIC APPROACH
Robert J. Aumann and Lloyd S. Shapley Nov. 1968 164 p refs
(Contract F44620-67-C-0045)
(AD-678882; RM-5468-PR-Pt-1) Avail: CFSTI CSCL 12/2

First of a series of studies concerned with the value of participation in a non-atomic game. The value of an n-person game is a function that associates to each player a number that, intuitively speaking, represents an a priori opinion of what it is worth to him to play in the game. A non-atomic game is a special kind of infinite-person game, in which no individual player has any special significance. Such games have recently attracted attention as models for mass phenomena in economics. The extended definition of value is formulated in terms of simple axiomatic properties, such as symmetry, linearity, and positivity. Questions of existence and uniqueness are considered. For a certain class of games where the non-atomic measures are vectors rather than scalars, an explicit formula is derived that enables the value to be calculated directly. Author (TAB)

N69-17828 Rockefeller Univ., New York.
SOME NONLINEAR NETWORKS SUGGESTED BY LEARNING THEORY
Stephen Grossberg (Ph.D. Thesis) 1967 209 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-9583

Several systems of nonlinear difference-differential equations and proof of oscillation and global ratio limit theorems for some of them are introduced. These systems can be interpreted as a learning theory, or alternatively as a nonstationary prediction theory whose goal is to discuss the prediction of individual events, in a fixed order, and at prescribed times. They can also be interpreted as cross-correlated flows on networks, or as deformations of a probablistic graph. Each system possesses an underlying geometry characterized by a semistochastic matrix, and the effect of this geometry on the system's limiting behavior as $t \to \infty$ is studied.
Dissert. Abstr.

N69-17834# Texas A&M Univ., College Station. Inst. of Statistics.
NON-CONVEX PROGRAMMING
H. O. Hartley and R. R. Hocking 26 Nov. 1968 25 p refs
(Contract N00014-68-A-0140; Proj. Themis)
(AD-679618; THEMIS-TR-6) Avail: CFSTI CSCL 12/2

The paper is concerned with the solution of the problem, minimize f sub o(x,y), subject to the constraints, f sub i(x,y) = or < 0, $i = 1, \ldots, m$, when the functions f sub i(x,y) are not necessarily convex in the variables x and y. In particular, it is assumed that we may write f sub i(x,y) = h sub i(x) - g sub i(y), $i = 0, \ldots, m$ where the h sub i(x) are convex functions of the n-vector x but nothing is assumed about the functions g sub i(y) which depend on the N-vector y. Techniques are proposed for obtaining relative optima for the general problem and global optima for certain special cases.
Author (TAB)

N69-17839# Michigan Univ., Ann Arbor. Systems Engineering Lab.
ALGEBRAIC ISOMORPHISM INVARIANTS FOR TRANSITION GRAPHS Periodic Technical Report, Apr. 1965–Dec. 1967
John Frederick Meyer Griffiss AFB, N. Y. RADC Nov. 1968 197 p refs
(Contract AF 30(602)-3546)
(AD-679596; RADC-TR-68-351; Rept-06920-19-T) Avail: CFSTI CSCL 12/1

Transition graphs, which correspond to partial transformations on a finite set, are studied from an algebraic point of view in terms of a natural representation of the graphs by linear transformations, the representation being natural in the sense that its matrix equivalent coincides with the usual representation of graphs by adjacency matrices. Under this representation, the classical invariants of linear transformation similarity become invariants of graphical isomorphism and the principal objective of the investigation is to determine the extent to which these algebraic invariants specify the structure (isomorphism class) of an arbitrary transition graph.
Author (TAB)

N69-17871 California Univ., Berkeley.
OPERATORS AND INNER FUNCTIONS
Shirley Lynn Jackson, Jr. (Ph.D. Thesis) 1967 61 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-10344

The relationship is studied between certain properties of operators T on a Hilbert space H (principally, the existence of a proper invariant closed subspace), properties of S-invariant subspaces of H^2_γ, and the relationships between these two classes of properties. Here, H^2_γ is the Hilbert space of analytic, square-integrable, H-valued functions defined on the unit circle; and S is the operator on H^2_γ defined by $S(F(e^{i\theta})) = e^{i\theta}F(e^{i\theta})$. Rota, which represents any operator T with spectral radius less than one on a subspace of H^2_γ, is introduced. This construction is used to transform questions about T into questions about an S-invariant subspace, M_T, of H^2_γ. An explicit formula for an inner function with range M_T is given. An alternate construction to that of Rota is introduced and its properties are investigated. It is shown that an arbitrary S-invariant subspace of H^2_γ is closely related to one obtained from an operator by this construction.
Dissert. Abstr.

N69-17874# Wisconsin Univ., Madison. Mathematics Research Center.
PROCEDURES FOR A BEST POPULATION PROBLEM WHEN THE CRITERION OF BESTNESS INVOLVES A FIXED TOLERANCE REGION Technical Summary Report
Irwin Guttman and Roy C. Milton May 1968 21 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679922; MRC-TSR-883) Avail: CFSTI CSCL 12/1

Tables of constants necessary to use the procedures developed by Guttman (1961, Ann. Inst. Stat. Math., 13 pp. 9-26) are given. In addition a new procedure for a similar problem is given, and it is proved that the procedure is parameter-free at level P^*
Author (TAB)

N69-17875# Wisconsin Univ., Madison. Mathematics Research Center.
TOWARDS A THEORY OF MANY PLAYER DIFFERENTIAL GAMES Technical Summary Report
James H. Case Jan. 1968 41 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679921; MSC-TSR-839) Avail: CFSTI CSCL 12/2

The theory of two person zero-sum Differential Games is extended to games involving an arbitrary number of players. Explicit solutions are obtained for a class of such games.
Author (TAB)

N69-17897 California Univ., Berkeley.
GENERALIZED SCALES IN MODEL THEORY
Stephen Herman Hechler (Ph.D. Thesis) 1967 46 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10335

It is shown that scales need not have cardinality $\aleph_1$, but may have essentially any (regular) cardinality greater than $\aleph_0$ and less than or equal to that of the continuum. More precisely, it is shown that given a countable standard model M of ZF + AC and a partial order $\langle S, <_S \rangle$ in it with cardinality (with respect to M) less than or equal to that of the continuum, it is possible to construct a Cohen extension N in which cardinals and the cardinality of their power sets remain absolute, and in which $\langle S, <_S \rangle$ is embeddable in $^\omega\omega$. Further, if for every countable (in M) subset C of S there is an element $d \in S - C$ such that $c \in C \rightarrow c <_S d$ then the image of S in $^\omega\omega$ will be a generalized scale with further interesting properties. Thus if in some countable standard constructible model M there are two cardinals $\aleph_\alpha \leq \aleph_\beta$ neither of which is cofinal with ω, a countable standard extension M' of M is obtained which is a model of ZF + AC + card $(2^{\aleph_0}) = \aleph_\beta$.
Dissert. Abstr.

N69-17899 California Univ., Berkeley.
STUDIES IN PURSUIT-EVASION DIFFERENTIAL GAMES
Noboru Sugino (Ph.D. Thesis) 1967 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-10420

An important class of closed-loop differential games arising from the study of pursuit-evasion games is investigated by means of discrete time approximations. It is shown that the values of the approximating discrete games converge to a limit as h tends to zero and the limit coincides with the appropriately defined value of the time-continuous game if the minimax theorem holds. A set

of sufficient conditions for insuring the validity of the minimax relation is derived. The discussions make essential use of geometric attainability sets and iterative relations by dynamic programming.
Dissert. Abstr.

N69-17932# Institut Franco-Allemand de Recherches, St. Louis (France).
GENERATION OF ACCIDENTAL NUMBERS [ERZEUGUNG VON ZUFALLSZAHLEN]
V. Fleck 19 Jul. 1967 25 p refs In GERMAN
(ISL-N-10/67) Avail: CFSTI

Described are computer methods for generating random numbers of rectangular and normal distribution. An example calculation in FORTRAN language is presented.
Author

N69-17966 Oklahoma State Univ., Stillwater.
SINGULAR EXTENSIONS AND COHOMOLOGY OF LIE ALGEBRAS
Peter Craig Morris (Ph.D. Thesis) 1967 57 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-8465

This paper deals with interrelations among singular extensions and second cohomologies of Lie algebras over an arbitrary commutative ring with unity. An example is given to illustrate the theory, after the interrelations studied are exhibited in detail.
Dissert. Abstr.

N69-18021# Wisconsin Univ., Madison. Mathematics Research Center.
DUAL EQUATIONS AND CLASSICAL ORTHOGONAL POLYNOMIALS Technical Summary Report
Richard Askey Feb. 1968 16 p refs
(Contract DA-31-124-ARO(D)-462
(AD-679923; MRC-TSR-845) Avail: CFSTI CSCL 12/1

Dual integral equations involving Bessel functions and dual series equations involving Jacobi polynomials occur in several branches of applied mathematics and large classes of these equations can now be solved. We show how many dual sequence equations involving Jacobi and Laguerre polynomials can be solved by similar methods.
Author (TAB)

N69-18024*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt Md.
POWER SERIES SOLUTIONS OF THE THIELE-BURRAU REGULARIZED PLANAR RESTRICTED THREE-BODY PROBLEM
R. H. Estes and E. R. Lancaster Nov. 1968 13 p refs
(NASA-TM-X-63417; X-643-68-461) Avail: CFSTI CSCL 12A

This power series method applies to global transformations proposed by Thiele (1895) and Burrau (1906) which have advantages over other global regularizations, since the equations of motion in this system contain only derivatives and transcendental functions of the dependent variables. Because the trigonometric and hyberbolic functions in the equations themselves satisfy simple differential equations, this regularization is particularly amenable to calculating series coefficients by recurrent power series techniques. The power series equations were programmed in double precision on an IBM 360, Model 91 computer using optimal integration procedures and were compared with a non-regularized recursive power series method. The results of the given example reveal a 33% decrease in computing time, as well as two more digits of accuracy in the Jacobi constant after one complete orbital integration. Although the full power of this integration technique will be realized with collisions or near collisions involving both primaries, the given situation demonstrates very favorable results in less extreme problems.
A.C.R.

N69-18105*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
COMPUTATION OF OPTIMAL SINGULAR CONTROLS
D. H. Jacobson, S. B. Gershwin, and M. M. Lele Jan. 1969 26 p refs
(Grant NGR-22-007-068; Contract N00014-67-A-0298-0006; Proj. NR-372-012)
(NASA-CR-99492; TR-580) Avail: CFSTI CSCL 12A

A class of singular control problems is made non-singular by the addition of an integral quadratic functional of the control to the cost functional; a parameter $\epsilon > 0$ multiplies this added functional. The resulting non-singular problem is solved for a monotone decreasing sequence of ϵ's: $\epsilon_1 > \epsilon_2 \cdots > \epsilon_k > 0$. As $k \to \infty$, and $\epsilon_k \to 0$, the solution of the modified problem tends to the solution of the original singular problem. A variant of the method which does not require that $\epsilon \to 0$ is also presented. Four illustrative numerical examples are described.
Author

N69-18124 University of Southern Calif., Los Angeles.
ERGODIC PROCESSES AND OPTICAL COHERENCE THEORY
James Donald Arnett (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-10221

This dissertation is concerned with coherence theory as a system optimization criterion. The general mathematical model was constructed from ergodicity through wide sense ergodicity, that is fundamental to the concept of coherence functions as appearing in the literature. Several theorems are developed pertaining to the ergodic random process and the wide sense ergodic random process. A general discussion on coherence functions is given and a specific coherence function (due to Young) is adopted for use in optimizing optical systems. Two numerical examples are given; one for a Cassegrainian system, the other for a spherical mirror and photographic plate. In both cases, a spherical correcting mirror is assumed and its optimum radius is determined.
Dissert. Abstr.

N69-18134 Florida Univ., Gainesville.
SOLUTION OF LAPLACE'S PARTIAL DIFFERENTIAL EQUATION USING HYBRID COMPUTATION
James Robert Ashley (Ph.D. Thesis) 1967 127 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-9452

The solution of boundary value problems for Laplace's equation is studied starting from the classical method of separation of variables. A computing approximation is developed which reduces the two-dimensional Laplace equation within axially symmetric boundaries to ordinary differential equations. The approximation can be applied to any boundary radius which can be expressed as a single valued function of the axial variable. The degree of approximation is estimated by use of axial expansion forms of the solution to Laplace's equation. One method for implementing the computing approximation is to solve the equation in the axial direction on a run-hold-run basis. During the hold interval, a solution for the radial equation is iterated to match the boundary potential. Another solution scheme first finds the axial potential and its derivatives and then extends the solution between the axis and the boundary.
Dissert. Abstr.

N69-18164 Oklahoma State Univ., Stillwater.
SAMPLE SIZE DETERMINATION FOR BAYESIAN TOLERANCE INTERVALS
Robert Gene Easterling (Ph.D. Thesis) 1967 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-8395

A study is made of accuracy criteria and their relationship to sample size for a Bayesian approach to tolerance limits. Two types of tolerance intervals are considered: (1) q tolerance intervals for p coverage and (2) p-expected coverage tolerance intervals. For

the former a non-Bayesian accuracy criterion is adapted to the Bayesian approach. For the latter a new accuracy criterion is proposed and a multi-stage sampling algorithm developed for obtaining Bayesian tolerance intervals of a specified accuracy. The sensitivity of p-expected coverage tolerance intervals for the exponential density to an incorrect assumption of the prior density is also investigated. Dissert. Abstr.

N69-18168 Pittsburgh Univ., Pa.
LYAPUNOV STABILITY THEORY AND THE STABILITY OF SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS
Gabe Rinse Buis (Ph.D. Thesis) 1967 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-9736

The objective is to develop a mathematically rigorous Lyapunov stability theory for a class of partial differential equations. The approach taken to this problem is that of generalizing Lyapunov's direct method for ordinary differential equations to a class of operator differential equations. The second stage is to formulate partial differential equations in the framework of the operator differential equations. The next step is to associate boundary conditions with the formal partial differential operator. Subsequently, the developed stability theory is applied to a class of evolution equations with strongly elliptic partial differential operators and Dirichlet boundary conditions, giving sufficient conditions for asymptotic stability of the null solution. A similar formulation is given for a class of wave equations. Dissert. Abstr.

N69-18229# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
ON A CRITERION FOR FILTERING PARASITE SOLUTIONS IN A NUMERICAL COMPUTATION [SUR UN CRITERE PERMETTANT DE FILTRER DES SOLUTIONS PARASITES DANS UN CALCUL NUMERIQUE]
Radyadour Kh. Zeytounian 1968 21 p refs In FRENCH; ENGLISH summary Presented at the Intern. Symp. on the Quick Computation in Fluid Dyn., Monterey, U.S.A., 19–24 Aug. 1968 Submitted for publication
(ONERA-TP-614) Avail: CFSTI

In many cases, a fluid dynamics problem has to be solved with boundary conditions at infinity. If a digital solution has to be found the difficulty lies in the fact that it is almost impossible to satisfy such conditions. It is then necessary to transform the problem either into a CAUCHY Problem, or into a problem with boundary conditions within finite range. This solution consequently introduces some of the proper functions belonging to the equation as parasites. A method is proposed to eliminate these parasite solutions: it consists of the introduction of a function that will allow the control of the parasite in a given domain so that the problem will be limited to a boundary problem (in the case of an elliptical equation). The method is applied to a flow upstream of a body in a gravitational field. ESRO

N69-18233# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF THE RUNGE-KUTTA METHOD TO THE SOLUTION OF FREDHOLM INTEGRO-DIFFERENTIAL EQUATIONS
L. M. Likhtarnikov Apr. 1968 15 p refs Transl. into ENGLISH from Zh. Vychislite'noi Mat. i Mat. Fiz. (Moscow), v. 7, no. 4, 1967 p 899-905
(AD-679501; FTD-HT-23-1655-67) Avail: CFSTI CSCL 12/1

The necessary conditions and assumptions are given for applying the Runge–Kutta method to solver solving Fredholm integro-differential equations. The procedure is similar to that used in the numerical solution of ordinary differential equations. The final solution is reduced to the solution of a system of nonlinear algebraic equations. Author

N69-18270 Princeton Univ., N.J.
OPTIMIZATION BY ADAPTIVE RANDOM SEARCH
Michael Alan Schumer (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-9693

Techniques for locating the minimum (or maximum) of a unimodal function of several variables find application in many areas of technology, especially in the design of adaptive control and communication systems. Call the function to be minimized $Q(x_1, \ldots, X_n)$, and assume that the only quantities accessible to direct measurement are the values of Q. The fixed step size random search method (FSSRS) consists of choosing a random direction, moving in that direction with a step of size s, measuring the value of Q at the new position, and comparing it to the smallest previously observed value of Q. If no improvement is found the negative of the step is added to the next random step. This process is continued until the minimum is found to within the desired accuracy. Dissert. Abstr.

N69-18276 Brandeis Univ., Waltham, Mass.
AMBIENT SURGERY AND TANGENTIAL HOMOTOPY QUATERNIONIC PROJECTIVE SPACES
Douglas Nelson Hertz (Ph.D. Thesis) 1968 72 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-9934

The first section of this thesis is devoted to a discussion of the technique of surgery. It is proven that in certain cases one can perform surgery on a submanifold N of a manifold M so that the modified manifold is also a submanifold of M. In the second section the study of 4n-manifolds of the tangential homotopy type of QP_n, $n \geq 2$, is begun. Dissert. Abstr.

N69-18277 Texas Technological Coll., Lubbock.
CHARACTERIZATIONS OF GENERALIZED INVERSES FOR MATRICES
Gerald Lavoy Morris (Ph.D. Thesis) 1967 96 p
Avail: Univ. Microfilms: HC $5.00/Micorfilm $3.00 Order No. 68-2619

Except in the last paragraph all matrices are defined over the complex field. A^* is the conjugate transpose of A. DEFINITIONS. (a) X is a generalized inverse for A if and only if AXA = A. (b) X is a reflexive generalized inverse for A if and only if AXA = A and XAX = X. (c) X is a normalized generalized inverse for A if and only if AXA = A, XAX = X, and $(AX)^* = AX$. (d) X is a pseudo inverse for A if and only if AXA = A, XAX = X, $(AX)^* = AX$, and $(XA)^* = XA$. There exist T-normalized generalized inverses for A if and only if rank A = rank A^TA. There exists a T-pseudo inverse for A if and only if rank A = rank A^TA = rank AA^T. If a T-pseudo inverse exists, then it is unique and is given by $A^T(AA^T)^\#\ A(A^TA)^\#\ A^T$ where $(AA^T)^\#$ and $(A^TA)^\#$ are symmetric, reflexive generalized inverses for AA^T and A^TA respectively. Dissert. Abstr.

N69-18281 Pittsburgh Univ., Pa.
TIME VARYING UPPER BOUNDS ON NONLINEAR SYSTEM RESPONSES
Kommareddy Chinnapareddy (Ph.D. Thesis) 1967 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No 68-9738

The objective of this dissertation is to obtain explicitly time-varying upper bounds on the transient response $|\delta(t)|$ and $||_E(t)||$, to the initial condition disturbance x(0), of a class of absolutely stable nonlinear systems described by differential equation $\dot{x} = A x + b\,y$, $y = \phi(\delta)$, $\delta = c' x$; where A is a stable matrix with characteristic roots λ_i (i = 1,2, . . . , n), and $\phi(\delta)$ is a single-valued, piecewise continuous nonlinear function of δ satisfying $0 \leq \phi(\sigma)/\sigma \leq k$ and $\phi(\sigma) = 0$ only if $\delta = 0$. The transfer function of the linear part of the system is $G(s) = -\sum (s)/Y(s) = c'(s)$

A) [1]b. The basic results are derived via frequency domain inequality conditions as well as a specially constructed Liapunov function of the type "a quadratic form plus an integral of the nonlinear function." The principal contributions are presented by Theorems. Dissert. Abstr.

N69-18299*# Rensselaer Polytechnic Inst., Troy, N.Y.
ANALOG SENSITIVITY DESIGN, VOLUME 2 Final Report, 4 May 1967–3 Nov. 1968
James H. Rillings 3 Nov. 1968 151 p refs
(CONTRACT NAS8-21131)
(NASA-CR-98274) Avail: CFSTI CSCL 12B

The method of Analog Sensitivity Design (ASD) is developed to solve the sensitivity design problem. This method employs the simultaneous solution of the state and sensitivity equations of the dynamic system on a repetitive operation analog computer and an automated hill climbing iterative solution technique. A structural method is described where ASD can be used when the response of an existing physical device with an unknown mathematical description is to be desensitized to one or more of its parameters. Some of the other unique advantages of ASD are discussed and a simple second order example is solved. A case study involving the design of a feedback control system for the Saturn V–Apollo is presented. The control system is to be insensitive to changes in the natural frequencies of the bending modes of the vehicle. The equations of motion are derived, a brief discussion of wind disturbances acting on the vehicle is given and a design wind selected. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-17244# New York Univ., N. Y. Geophysical Sciences Lab.
SNOW PREDICTION IN THE EASTERN UNITED STATES Final Report
Jerome Spar, Joseph R. Bocchieri, Robert A. Godfrey, and James P. Travers Jul. 1968 85 p refs
(Contract E-1-68(N))
(GSL-TR-68-10; PB-180213) Avail: CFSTI CSCL 8L

The report describes further efforts to develop objective methods for prediction of onset time of snow, discrimination between rain and snow, and the forecasting of total snow depth from coastal cyclones at New York City. An experiment in local numerical weather prediction by the National Meteorological Center is described. The use of aircraft reconnaissance of cyclones for winter coastal weather prediction is discussed. Author (USGRDR)

N69-17325# Weather Bureau, Silver Spring, Md. Equipment Development Lab.
A WEATHER DATA RADIO TELEMETRY SYSTEM
Robert R. Knibb and Francis V. Kohl Jan. 1969 30 p refs
(WBTM-EDL-7) Avail: CFSTI

A system is described for telemetering weather sensor information by low-powered VHF–FM radio. It is particularly adapted for use at airports where end-of-runway sensors may be several miles from the observer's readout console, and where essentially line-of-sight radio paths exist. The system can accommodate analog voltage, pulse duration, and pulse count types of data signals. The engineering model described serves as a telemeter for wind speed and direction, temperature, and dew point. Standard Weather Bureau sensors and readout panels are used, except for wind direction, for which modified standard instruments are used. Author

N69-17352# Weather Science, Inc., Norman, Okla.
BALLOON TRANSPONDER STUDIES OF SEVERE STORM SYSTEMS Final Report
Donald R. Hall, Dale C. Hall, and Hoyt E. Hart 15 Oct. 1968 90 p refs
(Contract E22-121-68-(N))
(PB-180269) Avail: CFSTI CSCL 04B

A great deal of significant local storm data was gathered using balloon-transponder systems during the 1968 season. Additionally, important knowledge was gained with respect to the strengths and weaknesses of the constant-volume balloon as a severe storm probe. Author (USGRDR)

N69-17374# Ohio State Univ. Research Foundation, Columbus.
GLACIOLOGY AND METEOROLOGY OF ANVERS ISLAND. VOLUME 1: SURFACE METEOROLOGICAL DATA FOR PALMER STATION, ANTARCTICA, FEBRUARY 1–DECEMBER 31, 1965. PRELIMINARY REPORT
Arthur S. Rundle, William F. Ahrnsbrak, and Charles C. Plummer Jun. 1968 373 p
(Grant NSF GA-165)
(PB-180254) Avail: CFSTI

The volume presents, in tabular form, the results of surface meteorological observations made at the United States Antarctic Research Program facility, Palmer Station, between February 1 and December 31, 1965. These data represent a preliminary report in limited edition, while a detailed analysis for final publication is in progress. Further volumes in this series will include surface meteorological observations for 1966, meteorological observations at an ice cap station for 1965 and 1966 and geological results for 1966. USGRDR

N69-17491# Meteorological Research Inst., Tokyo (Japan).
A MESOMETEOROLOGICAL STUDY OF A SUBTROPICAL MESOCYCLONE
Hidetoshi Arakawa, Kazuo Watanabe, Kiyoshi Tsuchiya (Japan Meteorol. Agency), and Tetsuya Fujita (Chicago Univ.) May 1968 33 p refs
(Grants CWB-E-86-67-(G); NSF GF-255)
(SMRP-68) Avail: Issuing Activity

In order to establish the classification of a mesoscale cyclone of September 1, 1960, which formed over tropical waters and landed over Japan the next day, the cyclone was located on a maximum wind-speed vs. storm diameter diagram. The cyclone was then classified as a subtropical mesocyclone because it was located on the border line between mesocyclones and tropical depressions. The mesocyclone was accompanied by arc-shaped echoes around the center and by a curved echo band in the eastern sectors far from the center. An area of composite mesohighs was accompanied by the echo band. A three-dimensional analysis of the wind field was made by making use of the existing techniques of time-to-space conversions and of new methods of interpolation for construction of vertical space cross sections. Results showed that the subtropical mesocyclone was characterized by an overall mass inflow which was between a large thunderstorm and a mature hurricane. Author

N69-17497# Environmental Technical Applications Center (Air Force), Washington, D. C.
GUIDE FOR APPLIED CLIMATOLOGY

Nov. 1968 168 p refs
(AD-679541; AWS-PAM-105-2) Avail: CFSTI CSCL 12/2

The pamphlet explores the functions of an applied climatological unit especially orientated towards, but not limited to, support of the military. The data base available within the Environmental Technical Applications Center (ETAC) is explained in detail. Statistical probabilistic and empirical applications to climatic procedures are illustrated and several examples of problem-solving techniques are included. Author (TAB)

N69-17507# Environmental Science Services Administration, Las Vegas, Nev. Air Resources Lab.
CLIMATOLOGICAL DATA, NEVADA TEST SITE AND NUCLEAR ROCKET DEVELOPMENT STATION
Ralph F. Quiring Aug. 1968 180 p refs Prepared in cooperation with AEC
(PB-180212; ERLTM-ARL-7) Avail: CFSTI CSCL 04B

The summary provides a collection of climatological data for the Nevada Test Site and Nuclear Rocket Development Station. The data and analysis are presented as samples from substantially different topographic environments to show the salient features of the seasonal and diurnal variations of wind and temperature near ground level and aloft. An evaluation of precipitation data for a 20-station net-work on the test site and a 5-yr climatological summary for the continuously manned Yucca weather station are included. Author (USGRDR)

N69-17533# Weather Wing (4th), Ent AFB, Colo. Aerospace Sciences Div.
SEVEN MARCH WEATHER IN SOUTHEASTERN UNITED STATES FOR ECLIPSE RESEARCH PLANNING
Clarence E. Everson Dec. 1968 63 p refs
(AD-679990) Avail: CFSTI CSCL 4/2

Climatological information in southeastern United States for solar eclipse research on 7 March 1970 is presented. Author (TAB)

N69-17576# RAND Corp., Santa Monica, Calif.
METEOROLOGICAL CONDITIONS AFFECTING ARCTIC SOUND PROPAGATION
E. S. Batten and C. Schutz Nov. 1968 38 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-679545; RM-5714-PR) Avail: CFSTI CSCL 4/2

A description of the effects of vertical temperature distribution and wind on the propagation of sound in the lowest layers of the Arctic atmosphere. Variations in temperature profiles are examined seasonally, daily, and diurnally under various wind conditions, and the behavior of the wind within the friction layer of the atmosphere is explored. The theory of the Ekman spiral is used to compute the theoretical distribution of wind speed and sound speed as a function of azimuth for three characteristic temperature profiles as a function of azimuth. Considering temperature alone, the calculations show that supernormal audibility will probably be common during the polar night and perhaps during the summer twilight. Author (TAB)

N69-17587# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIURNAL AND ANNUAL VARIATION IN THE PROBABILITY OF VISIBILITY BELOW 10 km
Ye. N. Dovgyallo 14 May 1968 9 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 184, 1966 p 44-47
(AD-679805; FTD-HT-23-269-68) Avail: CFSTI CSCL 4/1

Horizontal visibility of the atmospheric layer near the ground is subject to daily and yearly fluctuations. The author utilized visibility data from geographic points with widely differing climatic conditions: Alma-Ata, Kiev, Batumi, Karadag, Tashkent, Sverdlovsk, Murmansk, Vladivostok, Petropavlovsk-Kamchatskiy, and Yuzhno-Kurilsk. The fluctuations of visibility in all the locations were similar, the highest visibility being in the summer months. The relative humidity curves show the same trend. Daily visibility varied in a similar manner, the highest visibility being in the morning. TAB

N69-17615# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE STATISTICAL STRUCTURE OF FIELDS OF AIR TEMPERATURE AND PRESSURE
T. P. Svetlova 4 Jun. 1968 18 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 194, 1966 p 28-36
(AD-679503; FTD-MT-24-67-68) Avail: CFSTI CSCL 4/2

An electronic computer was used to investigate the space structural and correlation functions of average monthly air temperature near the earth and pressure at sea level. The article presents an analysis of the results of special calculations designed to expose erroneous data used in connection with an objective analysis of meteorological fields. The work was performed in connection with the automation of the hydrometeorological network where there is special importance in the automatic exclusion of gross errors in data from observations. Author (TAB)

N69-17656# Weather Squadron (8th), Detachment 20, Clinton-Sherman AFB, Okla.
TERMINAL FORECAST REFERENCE FILE, VOLUME 1
Dec. 1968 46 p
(AD-679812) Avail: CFSTI CSCL 4/2

A reference file for forecasters containing a description of the local area, climatology, weather regimes, rules of thumb and forecast studies. Author (TAB)

N69-17772*# National Aeronautics and Space Administration, Washington, D. C.
A COMPARISON OF DATA OBTAINED BY THE MT-135 AND ARCAS METEOROLOGICAL ROCKET SYSTEMS
A. J. Miller (ESSA, Washington), H. M. Woolf (ESSA, Washington), and F. G. Finger (ESSA, Washington) Feb. 1969 23 p refs
(NASA-TM-X-1726) Avail: CFSTI CSCL 04B

Results of comparisons of wind and temperature data obtained by closely spaced launchings of Japanese MT-135 and American ARCAS meteorological rocket systems are presented. In general, smoothed temperature profiles show a certain disagreement that is unexplained at this time. Perturbation profiles of wind and temperature, on the other hand, indicate a high degree of correlation that tends to substantiate the existence of small-scale features. Author

N69-17832# Weather Bureau, Silver Spring, Md.
FEDERAL METEOROLOGICAL HANDBOOK NO. 3: RADIOSONDE OBSERVATIONS
Jan. 1969 163 p refs Prepared by Navy
(AD-679614; NAVAIR-50-1D-3) Avail: SOD $1.25; CFSTI CSCL 4/2

Radiosonde observations, or RAOBS as they are termed, are made to determine the pressure, temperature, and humidity from the surface to the point where the balloon bursts. The radiosonde consists of meteorological measuring elements coupled to a radio transmitter and assembled into a small lightweight box. The device is carried aloft by a balloon filled with hydrogen or helium gas. Included in the train is a small parachute to slow the descent of the instrument after the balloon bursts, thereby minimizing the danger of injury to life and property. As the balloon rises, measurements of pressure, temperature, and relative humidity are transmitted to a ground station where the data are recorded automatically. This handbook deals primarily with those procedures necessary in taking the RAOB. Author (TAB)

N69-18031 Meteorological Office (Gt. Brit.).
UPPER AIR OBSERVATIONS AT THE SEYCHELLES, 1963–1964
P. B. Wright and R. A. Ebdon 1968 87 p refs *Its* Geophys. Mem. No. 111, 1st No., Vol. 15 (MET.O.808a) Avail: UK 11s

Daily values of height, temperature, humidity and wind at standard pressure levels are presented for the period September 1963 to December 1964. These data are discussed, and compared with similar data from Gan. Author

N69-18172 National Lending Library for Science and Technology, Boston Spa (England).
THE FILTRATION OF TIME SERIES IN HYDROMETEOROLOGY
G. V. Matushevskii 10 Dec. 1968 19 p refs Transl. into ENGLISH from Okeanologiya (Moscow), no. 8, 1968 p 502–513 (NLL-M-560-(9022.551)) Avail: Natl. Lending Library, Boston Spa, Engl.

A mathematical concept of the linear filtration of random time functions is given which is used to pick out from the initial observations the oscillations of the given frequency ranges. Weighting functions and frequency response functions of the following lowpass filters are presented: the moving equilibrium average, normal, triangular, filters of Tuki and Doodson, and hydrodynamic filter describing wave damping with depth. Highpass and bandpass filters are also considered. Three major properties of the filtration procedure are discussed: 1) length reduction of the filtered-out series (as compared to the initial one), 2) limitation of the frequency range under study from aloft (which is associated with the series length) and from the bottom (which is associated with the length of the sampling interval), 3) the relationship between mean values of the filtered-out and initial series. Filtration techniques are considered in detail. Some examples of the use of filtration in oceanography are presented in conclusion. Author

N69-18173 National Lending Library for Science and Technology, Boston Spa (England).
ON WINTER STRATOSPHERIC WARMINGS AND SPRINGTIME REVERSALS IN THE ANTARCTIC AND ARCTIC
A. S. Gatgerov [1968] 10 p refs Transl. into ENGLISH from Tr. Leningr. Gidrometeorol. Inst. (Leningrad), no. 10, 1967 p 22–31 (NLL-M-558-(9022.551)) Avail: Natl. Lending Library, Boston Spa, Engl.

A comparison is made between results of radiosounding and meteorological sounding in the Antarctic and in the Arctic. In winter, with intense development of the cyclonic vortex in the northern hemisphere, conditions in the Arctic stratosphere acquire features similar to those in the Antarctic stratosphere. Certain regularities appear in the onset of winter stratospheric warmings and spring reversals of circulation in the stratosphere of both polar regions. Author

N69-18178# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Block Res. in Geophys., Astronomy, and Space, No. 196 14 Jan. 1969 p 12-40 refs (See N69-18176 07-34) Avail: CFSTI

Several programs of the U.S.S.R. hydrometeorological services and their weather stations are outlined. Attached abstracts of scientific meteorological studies pertain to atmospheric circulation and composition and their effects on climatology, wave propagation, aerial photography, etc. G.G.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-17461# Massachusetts Univ., Amherst. School of Engineering.
OPTIMUM ALIGNMENT OF INERTIAL NAVIGATION SYSTEMS
C. E. Hutchinson and E. A. De Sousa Nov. 1968 88 p refs (Contract N00014-68-A-0146)
(AD-679906; THEMIS-UM-68-3) Avail: CFSTI CSCL 17/7

At present, the accuracy of an inertial navigation system is limited by the accuracy of the initial platform alignment process. The accuracy of the platform is further degraded by instrument errors; namely, gyro drifts, accelerometer errors, and independent velocity error sources. The specific alignment problem under consideration consists of placing the platform in a prescribed orientation as rapidly as possible under the constraints of maximum allowable error. The desire to align rapidly may be essential to successful mission accomplishments, so that limited restrictions are placed on the vehicle being navigated by inertial system. Consequently, it becomes necessary to design a control system to minimize the effect of these errors as rapidly as possible. This report compares two control schemes; namely, the Kalman estimator and the classical velocity feedback system, so that the best possible alignment be achieved. Presently the application of simple velocity feedback is the method employed in practice. However, with recent advances in modern control theory, the ability of the estimation scheme of Kalman to provide superior performance can be illustrated. The comparison is made with respect to two criteria: the ability of the control system to provide accurate alignment, and speed of response. A computer program has been developed to analyze and evaluate the relative merits of the optimum Kalman estimator and the classical feedback system. Author (TAB)

N69-17780*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SECOND ORDER ERRORS IN LINEARIZED VELOCITY CORRECTIONS AND THEIR EFFECTS ON THE RATE OF CONVERGENCE OF ITERATIVE SOLUTIONS
John D. McLean Washington Feb. 1969 37 p refs (NASA-TN-D-5037) Avail: CFSTI CSCL 17G

Two methods of computing linearized corrections are considered. The first, referred to as the linear method, computes the velocity correction as a linear function of position and velocity deviations at the time of the correction. The second method, referred to as the half-linear method, computes the trajectory ahead to the terminal time and then determines velocity correction as a linear function of the actual terminal error. The linear and half-linear guidance laws are presented together with formulas for predicting the errors in them caused by nonlinearity. These formulas are based on the assumption that the errors are adequately represented by second-order terms. Second-order errors are presented for both guidance methods on conic trajectories with eccentricities of 0.2, 0.98, and 2.0, and the errors for the two guidance methods are compared. A simulated lunar mission is used as an example to show how the data from the conic trajectories can be used to give a qualitative idea of the relative performance of the linear and half-linear methods on an n-body trajectory. The relative advantage of using the linear or half-linear method to compute the first velocity correction when iteration is used to reduce the residual error is investigated. Also, the effect of neglecting perturbing forces in calculating the state transition matrix is considered. Author

N69-17788*# National Aeronautics and Space Administration, Washington, D. C.
AIRCRAFT NAVIGATION
S. S. Fedchin et al Feb. 1969 570 p Transl. into ENGLISH of the book "Samoletovozhdeniye" Moscow, Transp., 1966
(NASA-TT-F-524) Avail: CFSTI CSCL 17G

The theory and practice of aircraft navigation at the modern level of aviation technology are summarized in this book: the most important practical problems of the utilization of general, radio engineering, and astronomical means of aircraft navigation are set forth; the procedure of the pilot's preparation for flight, the means of calculating the distance and duration of a flight, and the carrying out of prelanding maneuvering and landing of the aircraft under complex meteorological conditions during the day or at night are elucidated. The basic material of the book, sufficient for the practical mastery of the means and methods of aircraft navigation, is presented with the application of mathematics within the limits of a secondary school course. The problems which are necessary for a deeper study of the material are discussed in terms of principles of higher mathematics. The book is intended for pilots and navigators. It can be used as a textbook for students of civil aviation educational institutions. Author

N69-17795# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
OMEGA NAVIGATION COMPUTER SET, VOLUME 1 Final Report
B. Handlogten and G. R. Morin Sep. 1968 179 p refs
(Contract FA-66-WA-1573)
(AD-678377; SRDS-RD-68-37-Vol-1) Avail: CFSTI CSCL 17/7

The effort was concentrated in the areas of: (1) Studying the feasibility of implementing diurnal phase prediction models in an airborne computer; (2) Development of a digital navigation computer capable of interfacing with an existing Omega receiver; (3) Flight testing and analyzing the performance of the developed feasibility airborne Omega equipment set. Author (TAB)

N69-17796# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
OMEGA NAVIGATION COMPUTER SET, VOLUME 2 Final Report
B. Handlogten and G. R. Morin Sep. 1968 241 p refs
(Contract FA-66-WA-1573)
(AD-678378; SRDS-RD-68-37-Vol-2) Avail: CFSTI CSCL 17/7

The report contains the flight test data gathered in the FAA DC-6B aircraft. Author (TAB)

N69-17895# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHIPBOARD RECEPTION-INDICATOR "PIRS-1" FOR USE WITH PHASE RADIO-NAVIGATION SYSTEMS
A. Pavlov 28 Mar. 1968 8 p Transl. into ENGLISH of the book "Morskoy Flot"
(AD-679518; FTD-HT-23-1486-67) Avail: CFSTI CSCL 17/7

The article describes a newly developed reception indicator designed for installation in the merchant fleet. This instrument makes it possible to determine a ship's position by signals from the shore stations of a phase radio-navigation system. Either the time or the frequency can be varied. The article describes three different models of the apparatus. All three types are designed to be fed from the ship's electric circuit, and operates at voltages of 220 and 127 and a frequency of 50 cycles. The system operates from a vertical marine antenna with a length of 4 meters or more, installed at an angle of 50-60 degrees to the horizontal. The instrument is designed for continuous operation for a period of 48 hours, with a rest period of not less than 2 hours, and a speed of the vessel up to 25 knots. Installation of the instrument aboard ship is scheduled to start this year. Author (TAB)

N69-18036*# TRW Systems Group, Redondo Beach, Calif.
APOLLO SPACECRAFT SYSTEMS ANALYSIS PROGRAM. ANALYSIS OF RENDEZVOUS RADAR PEARL FLIGHT TEST DATA
S. Donald Dobby and Michael G. Doty 4 Nov. 1968 46 p refs
(Contract NAS9-8166)
(NASA-CR-92493; TRW-11176-H066-R0-00) Avail: CFSTI CSCL 22B

The results of the analysis of the Rendezvous Radar Test Flight Data from the White Sands Missile Range are presented in this report. The overall performance of the Rendezvous Radar based on review of the flight tests is very good. Most of the anomalies were caused by environmental phenomena such a multipath, antenna initial designation errors causing off boresight tracking, low transponder AGC and transponder "drop-out". A very small percentage of total data recorded contained anomalies which could possibly be attributed to the Rendezvous Radar. The multipath phenomenon is covered in detail and the derivation of the period and amplitude of oscillation due to multipath is presented in the appendix. Also presented is the application of the multipath phenomenon to the lunar mission, along with signal-to-noise versus range curves for additional reference. Author

N69-18078*# TRW Systems Group, Redondo Beach, Calif.
APOLLO SPACECRAFT SYSTEMS ANALYSIS PROGRAM. PRELIMINARY LR REFLECTIVITY MODEL
Edward T. Dickerson 31 Dec. 1968 9 p refs
(Contract NAS9-8166)
(NASA-CR-92469; TRW-11176-H098-R0-00) Avail: CFSTI CSCL 17G

Lunar reflectivity curves are charted for altitudes between 8,000 and 40,000 ft; 2000 and 8000 ft; below 2000 ft with 25 to 40 ft of surface roughness; and below 2000 ft with two to four ft of surface roughness. These curves are based on theoretical and measured data. In each case a band of uncertainty is specified. This band of uncertainty can be considered as a three sigma value of the reflectivity curves. B.P.

N69-18142*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PLANETARY PROBE GUIDANCE ACCURACY INFLUENCE FACTORS FOR CONJUNCTION-CLASS MISSIONS
Thomas B. Murtagh Washington Jan. 1969 31 p refs
(NASA-TN-D-4852) Avail: CFSTI CSCL 22C

The influence of spacecraft onboard radar data type and accuracy, of nominal entry trajectory parameters, and of planet radius uncertainty for unmanned planetary probe guidance is presented for a typical conjunction-class mission. The results of the analysis indicate that a probe guidance corridor on the order of 24 nautical miles can be obtained for a total midcourse velocity requirement less than 100 fps. The corridor results were more sensitive to variations in the nominal entry trajectory parameters than to variations in the assumed error in the radius of the target planet. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-17205# Oak Ridge National Lab., Tenn.
DESIGN OF AN ENGINEERING-SCALE, VACUUM DISTILLATION EXPERIMENT FOR MOLTEN-SALT REACTOR FUEL
W. L. Carter, R. B. Lindauer, and L. E. McNeese Nov. 1968 133 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2213) Avail: CFSTI

Experimental equipment was designed for an engineering-scale demonstration of vacuum distillation of molten-salt reactor fuel. The distillation is carried out at about 1000C and 1 mm Hg to separate LiF–BeF_2 carrier salt from less volatile fission products, primarily the rare earths. Uranium tetrafluoride is not present during the distillation. The experiment is designed for continuously feeding a molten salt-fission product mixture into a still at the same rate that distillate is being removed, thereby concentrating fission products in the still. Also, the still may be operated batch-wise to give large concentration factors. Frequent sampling of the distillate furnishes data on the separation between carrier and fission products as a function of concentration in the still bottoms. The equipment consists of a 48-liter feed tank, a 12-liter still, a 10-in. diam × 51-in. condenser, a 48-liter condensate receiver, plus associated temperature, pressure and level control instrumentation. Author (NSA)

N69-17216# Idaho Nuclear Corp., Idaho Falls.
FINDINGS ON CHLORIDE STRESS CORROSION IN THE MTR AND ETR PRIMARY SYSTEMS
R. P. Wadkins Aug. 1968 20 p refs
(Contract AT(10-1)-1230)
(IN-1250) Avail: CFSTI

The Materials Testing Reactor and Engineering Test Reactor have operated 13 years and 9 years, respectively, with no apparent chloride stress corrosion. Three different austenitic stainless steels are used in the test reactors, 347 in the MTR with 304 L and 304 being used in the ETR. Inspection of pipe samples from both systems show no corrosion. Dye penetrant checks in the area around nozzles in the ETR vessel show no stress cracks. Author (NSA)

N69-17218# Japan Atomic Energy Research Inst., Tokyo.
DEVELOPMENT OF IN-CORE VOID METER
Masahiro Satomi et al [1968] 16 p refs Transl. into ENGLISH from Trans. Soc. Instrum. Contr. Eng., v. 3, no. 3, Sep. 1967 p 229-235
(NSJ-tr-135) Avail: CFSTI

In order to measure steam void fractions in operating boiling water reactors, two types of void-meters, solenoid-type and digital-type, were developed. The former consists of a solenoid, a high frequency oscillator, a bridge and electric circuits and detects impedance change induced by voids passing through the solenoid. The latter uses a thin needlelike electrode as detecting head and detects the changes of capacitance and resistance induced when the electrode collides with and penetrates a bubble. Since the changes of impedances induced by void were very small, special electric circuits were devised to detect the signals. The solenoid type void-meter responds with high sensitivity and is suitable for measuring mean void fractions in the solenoid under transient conditions. The digital type void-meter is small in size and is applicable to measuring time-averaged local void fractions. These performances were examined through out-pile experiments. The detecting heads of the void-meters were designed and manufactured with special considerations to be used under conditions of high pressure and high irradiation. These void meters were used to measure void fractions in the chimneys and in the downcomer of operating reactor JPDR (Japan Power Demonstration Reactor, a boiling water reactor with natural circulation). Author (NSA)

N69-17224# Los Alamos Scientific Lab., N. Mex.
NEW METHODS AND TECHNIQUES IN NUCLEAR SAFEGUARDS RESEARCH AND DEVELOPMENT
Robert G. Keepin [1968] 25 p refs Presented at the Intern. Conf. on the Constructive Uses of Atomic Energy, Washington, D. C., 1968
(Contract W-7405-eng-36)
(LA-DC-10034; CONF-681101-4) Avail: CFSTI

Methods of detecting, identifying, and quantitatively analyzing fissionable materials in various practical configurations containing both fissionable and nonfissionable materials are discussed. Topics covered include: passive and active interrogation methods, parallel computational programs, detectors and sources, and practical assay applications. NSA

N69-17283# Kyoto Univ. (Japan). Research Reactor Inst.
A STUDY ON THE FAST-REACTOR NEUTRON SPECTRA BY THE SCATTERING PROCESS TECHNIQUE
Kazuhiko Inoue May 1967 26 p In JAPANESE
(KURRI-TR-35) Avail: CFSTI

The fast-reactor neutron spectra are described by other than the ordinary methods like that of multi-group theory. In a fast reactor, the neutrons are moderated through elastic and inelastic scattering. However, the chances that a neutron undergoes more than several inelastic scatterings are very small. For the elastic scattering, taking into consideration all the possible processes, the neutron spectrum is expanded by the number of inelastic scatterings. Further, as an expression containing multiple inelastic scatterings, the formula is shown in which the neutron spectrum is expanded as a series of the types of multiple inelastic scatterings. Using these formulas, examples of calculation are given for certain systems. By treating the fast-reactor neutron spectrum with scattering processes, the characteristics of the formation process and the approximate formula for fast-reactor neutron spectra are described. NSA

N69-17288# Atomic Energy Commission Research Establishment, Riso (Denmark).
DETECTOR OPTIMIZATION REGARDING GAMMA-RAYS PROBLEM IN NEUTRON NOISE MEASUREMENT
Vlada Teodosic Aug. 1968 13 p refs
(RISO-M-793) Avail: CFSTI

The very high gamma fields existing in power reactors present a serious problem in neutron noise measurements. This problem is discussed with particular attention paid to the shut-down reactivity measurements in power reactors performed by the frequency analysis of the neutron, as well as of the prompt-gamma noise. It is shown that careful selection and design of the detectors leads to considerable improvement of the accuracy. The recently developed method of the prompt-gamma noise analysis is presented and discussed. Author (NSA)

N69-17313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 1-MEGAWATT REACTOR DESIGN FOR BRAYTON-CYCLE SPACE POWER APPLICATION. PART 1: THERMAL ANALYSIS AND CORE DESIGN
Charles L. Whitmarsh, Jr. and Paul T. Kerwin Washington Feb. 1969 45 p refs
(NASA-TN-D-5013) Avail: CFSTI CSCL 18L

Thermal-hydraulic calculations were performed for a 1-Mw gas-cooled reactor designed to retain all fission gases and to operate for 25,000 hours with a coolant outlet temperature of 1650°K. These data were combined with neutronics data in an effort to minimize core size. Parameters investigated were fuel-element configuration, fuel-cladding temperature, radial and axial power distributions, coolant inlet temperature, coolant pressure, and reactor pressure drop. Author

N69-17314*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 1-MEGAWATT REACTOR DESIGN FOR BRAYTON-CYCLE SPACE POWER APPLICATION. PART 2: NEUTRONICS DESIGN
Charles L. Whitmarsh, Jr. and Paul T. Kerwin Washington Feb. 1969 33 p refs
(NASA-TN-D-5014) Avail: CFSTI CSCL 18L

General characteristics were determined for a gas-cooled reactor designed to operate at 1 Mw for 25,000 hours, with a coolant outlet temperature of 1650 K. Design curves relating core size to fuel concentration are presented as a function of radial power flattening. Author

N69-17347# Aktiebolaget Atomenergi, Studsvik (Sweden).
MEASUREMENTS AND PREDICTIONS OF BURNOUT CONDITIONS IN ROD BUNDLES
Kurt M. Becker May 1967 58 p refs Presented at the Symp. on Two-phase Flow, Bournemouth, Engl., 12–15 Jun. 1967
(S-366; CONF-670654-1) Avail: CFSTI

Burnout measurements for flow of boiling water in vertical 6-rod and 7-rod bundles and one 36-rod bundle are presented. The 6- and 7-rod bundle measurements showed that for rod distances larger than 4 mm, the burnout heat flux was independent of the rod clearance. The 36-rod bundle measurements were low by 18% compared with the correlation. This discrepancy was explained by the presence of an unheated center rod, which carried the spacer arrangements, and by the fact that the inner sub-channel of the cluster carried a heavier thermal load than the remaining sub-channels. A comparison between the measured heat fluxes for the 36-rod bundle and one of the 6-rod bundles, which in geometry was identical to the central portion of the 36-rod bundle, yielded almost identical results. Author (NSA)

N69-17439# Atomic Energy Commission Research Establishment, Riso (Denmark).
METHODS OF MEASURING REACTOR PARAMETERS BY AUTO-SPECTRA AND CROSS-SPECTRA STUDIES
Vlada Teodosic Aug. 1968 13 p refs
(RISO-M-791) Avail: CFSTI

A general discussion of the measurement and analysis of reactor noise, especially in the frequency domain, and the statistical accuracy of the results obtained is presented. Particular attention is paid to the possible use of the methods for determining the shutdown reactivity of power reactors. Author (NSA)

N69-17469# Argonne National Lab., Ill.
SAFETY ANALYSIS OF A NOMINAL 3700-LITER URANIUM DIOXIDE CORE IN THE ZPR-6 AND ZPR-9 FACILITY
G. K. Rusch and R. A. Karam Jul. 1968 10 p refs
(Contract W-31-109-ENG-38)
(ANL-6271-Add-2) Avail: CFSTI

The relevant safety characteristics and maximum credible accidents for 50-, 2600-, and 3700-liter UO_2 systems are compared. The calculations demonstrate that the proposed 3700-liter system can be built safely with no additional hazard, compared to the previously approved systems. NSA

N69-17484# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik.
INFLUENCE OF INTERNAL GEOMETRY ON RADIAL TEMPERATURE DISTRIBUTION OF FAST BREEDER FUEL ELEMENTS
H. Kaempf [1968] 37 p refs Transl. into ENGLISH from the German Rept. KFK-751 Sponsored by US-Euratom Fast Reactor Exchange Program
(EURFNR-532; EUR-3710; KFK-751) Avail: CFSTI

A fuel element model featuring hollow cylindrical fuel and clad is used to analyze the effects of internal geometry on radial temperature distribution. The fuel and clad are separated by a gap of constant width. Formulas are developed for characterizing the effects of central channel, fuel porosity, and fuel-clad gap changes during reactor operation. Other effects which change temperature distribution during reactor operation are characterized qualitatively. The internal geometry effects on temperature distribution are numerically evaluated and plotted. NSA

N69-17487# Bettis Atomic Power Lab., Pittsburgh, Pa.
ISOTOPIC ANALYSIS OF NATURAL URANIUM DIOXIDE FUEL IRRADIATED TO 22000 MWD/MTU: THEORY VERSUS EXPERIMENT Interim Memorandum
J. C. Stachew Aug. 1968 81 p refs
(Contract AT(11-1)GEN-14)
(WAPD-TM-766) Avail: CFSTI

The U and Pu isotopic distributions of 45 irradiated fuel rods of natural UO_2 are compared to theoretical predictions made using three-dimensional P-1 neutron diffusion techniques. The calculational technique is somewhat unique in that normalization to experimental results is made only by use of the total core energy output and measured critical rod bank heights. This is in contrast to normalizing each individual fuel rod burnup to the experimental value and then investigating resultant isotopic distributions in the rod. The comparison indicates good agreement but identifies the need for a spatial spectrum variation of the ^{238}U epithermal resonance absorption cross section and improved time dependence of the ^{238}U and ^{239}Pu cross sections. Author (NSA)

N69-17506# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
PROBLEMS OF SODIUM BOILING IN FAST REACTORS
D. Smidt, P. Fette, W. Peppler, E. G. Schlechtendahl, and G. F. Schultheiss Jun. 1968 35 p refs Presented at the European Two-phase Flow Meeting, Oslo, 18–20 Jun. 1968 Sponsored by US-Euratom Fast Reactor Exchange Program
(EURFNR-564; EUR-3960; KFK-790) Avail: CFSTI

Ejection, superheat, and recondensation safety aspects of Na boiling in fast reactors are discussed. Bubble dynamics, superheat parameters, and recondensation modes are described. NSA

N69-17528# Los Alamos Scientific Lab., N. Mex.
AN INTEGRATED CIRCUIT CONTROL SYSTEM FOR THE PEWEE REACTOR
Bobby G. Strait and Robert M. Lang 20 Jun. 1968 7 p Presented at the 15th Nucl. Sci. Symp., Montreal
(Contract W-7405-ENG-36)
(LA-DC-9620; CONF-681017-2) Avail: CFSTI

A control system utilizing digital and linear integrated circuits was developed for low power testing of the Rover reactor, PEWEE. The control rod actuator employs electric stepping motors which are geared down to provide 0.01° resolution to the reactor rotary control rods. The system was designed to provide precision positioning capability for the control rods and features operating ease and versatility which minimizes the time and effort required to execute experiments. Author (NSA)

N69-17558# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Development Center.
PHYSICS VERIFICATION PROGRAM, PART 3 Quarterly Technical Report, Apr.-Jun. 1968
M. N. Baldwin and M. E. Stern Sep. 1968 18 p refs
(Contract AT(30-1)-3647)
(BAW-3647-9) Avail: CFSTI

The relating of the signal current from a Rh-type in-core power monitor to the neutron flux is described for temperatures approaching those of an operating power reactor. Measurements are made in borated and nonborated water. NSA

N69-17558# Oak Ridge National Lab., Tenn.
FUEL-CYCLE COST COMPARISONS FOR LOW ENRICHED URANIUM HIGH TEMPERATURE GAS-COOLED REACTORS
Don Steiner 9 Sep. 1968 57 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2173) Avail: CFSTI

Multigroup point-depletion physics calculations are performed for equilibrium fuel cycles without recycle; thermal-hydraulic performance and fuel cycle costs are determined for three fuel element designs. Power densities and pressure drops are calculated. Reactor design and operations parameters are given. Economics are detailed; data for the three fuel element designs are tabulated. NSA

N69-17611# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
EVALUATION OF TWO AMPEROMETRIC TITRATION METHODS FOR THE DETERMINATION OF PLUTONIUM IN URANIUM FUEL
V. Venkatasubramanian, R. W. Durham, and V. Corriveau Sep. 1968 21 p refs
(AECL-3206) Avail: Atomic Energy of Can., Ltd., Chalk River: $0.50

An accurate method for determining plutonium in irradiated UO_2 fuel is required for checking the reliability of computer calculations of burnup in nuclear power reactors. Two titration methods have been investigated both of which rely on amperometric end-point detection. One is the titration of Pu(VI) with Fe(II) after oxidation of the plutonium with silver peroxide and the other is the titration of Pu(III) with Cr(VI) after reduction of the plutonium with Ti(III). Both methods were found capable of producing precise and accurate results with pure plutonium solutions at the one mg level but the Ti(III) reduction method was more reliable where plutonium had been separated from uranium by anion exchange. This latter method was used to determine the plutonium content of the three zones of a fuel bundle irradiated to about 10 MWd/kg uranium in the Nuclear Power Demonstration Reactor (NPD). Author

N69-17623# Idaho Nuclear Corp., Idaho Falls. National Reactor Testing Station.
A HIGHLY EFFICIENT INORGANIC ADSORBER FOR AIRBORNE IODINE SPECIES (SILVER ZEOLITE DEVELOPMENT STUDIES)
W. J. Maeck, D. T. Pence, and J. H. Keller Oct. 1968 19 p
(Contract AT(10-1)-1230)
(IN-1224) Avail: CFSTI

A synthetic zeolite, Linde Molecular Sieve 13X, converted to the silver form strongly adsorbs inorganic and organic species of airborne iodine. As a filter material for the cleanup of iodine from reactor containment atmospheres, it has ideal properties of nonflammability, high-temperature operability with adsorption of iodine up to 500°C, retention of iodine up to 1000°C, and a rapid reaction time. Retentions of greater than 99.95% were measured for elemental iodine and for methyl iodide for a variety of conditions varying from dry flows at room temperature, dry flows at 500°C, and steam-air mixtures. Other promising applications of this type of material to the nuclear industry include cleanup of dissolver off-gas from chemical processing plant operations, filter materials for health physics safety devices such as face masks and air monitors, and adsorbing filters in sampling devices. Author (NSA)

N69-17638# Oak Ridge National Lab., Tenn.
A METHOD FOR THE MEASUREMENT OF INCREMENT FACTORS FOR GAMMA RADIATION IN THE ENERGY REGION OF 0.5 TO 15 MeV
W. Futtermenger 1966 83 p refs Transl. into ENGLISH from German Report ABS-THH-1019 (Hanover), Feb. 1968
(ORNL-TR-1869) Avail: CFSTI

A principle of measurement is described which permits determining the dose and energy absorption increment factors for gamma rays in the region of energy from 0.5 to 15 MeV required in calculation of shielding. The apparatus for measurement avoids large radiation fields. A narrow circled-down beam penetrates a model of the shield. The spectrum of the issuing gamma radiation is measured separately in the beam and in the field of lateral scattered radiation. From the two components, increment factors can be derived. With an electron accelerator for heterochromatic radiation and a sodium iodide scintillation crystal as detector, high sensitivities can be achieved and thereby large laminar thicknesses investigated. From the variation of the maximal energy of the applied heterochromatic gamma radiation increment factors for monoenergetic radiation can be obtained. The procedure was tested with iron as shielding material, so that a comparison with the known theoretical increment factors for iron could be made. The increment factors obtained in all cases lie within the limits of error of these comparative values. In a further series of experiments the hitherto unknown dose increment factors of a barite concrete were determined. Author (NSA)

N69-17639# Oak Ridge National Lab., Tenn.
INSTRUCTIONS FOR THE USE OF COMPUTER PROGRAMS AVAILABLE TO THE WORKING GROUP III CONSTRUCTION ENGINEERING FOR RADIATION SHIELDING
S. Sasse, H. Schubart, H. G. Vogt, and C. D. Wueneke Feb. 1967 50 p refs Transl. into ENGLISH from German Report ABS-THH-1034 (W. Ger.), 50 p
(ORNL-TR-1878) Avail: CFSTI

The programs provide shielding calculations for neutron and gamma radiations for different shield configurations. NSA

N69-17649# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
SNAP-23A, PHASE 1 Quarterly Progress Report, Jun. 1–Aug 31, 1968
W. S. Wilgus 30 Sep. 1968 106 p refs
(Contract AT(30-1)-3800)
(WANL-3800-21; WANL-PR-SS-019; QPR-8) Avail: CFSTI

Efforts devoted to reliability and systems design were concentrated on the modifications and assembly procedures necessary to rebuild the Experimental Mockup System (EMS) after failure. A layout of the instrumentation is given and the data to be monitored during EMS testing are tabulated. The design criteria to define a dual purpose shipping cask for the SNAP-23A heat source/biological shield assembly or the complete SNAP generator are given. A phase shift occurs during aging below 1100°F in the U-8 Mo shield. The source/shield assembly configurations are shown. Radial shield area insulation design, diffusion barrier design, heat source assembly heater design, and other design modifications are discussed. Materials testing includes stress rupture testing of U-8 Mo, spherical insulation testing, and thermal conductivity measurements. Predicted dose rates for the shield assembly and bare capsule are tabulated. NSA

N69-17680# Commissariat a l'Energie Atomique, Cadarache (France). Centre d Etudes Nucleaires.
INTRODUCTION TO THE STUDY OF AN OPTIMAL CONTROL FOR IRRADIATION LOOPS OF THE REACTOR PEGASE [INTRODUCTION A L'ETUDE D'UNE COMMANDE OPTIMALE DES BOUCLES D'IRRADIATION DU REACTEUR PEGASE]

Claud Guintrand Jul. 1968 73 p refs In FRENCH
(CEA-R-3453) Avail: CFSTI

The control system under consideration is made up of: a regulation unit consisting of a conventional nonlinear looped circuit for static tests; and a cycling unit operating in open loop for dynamic tests. After a definition of a mathematical model for an irradiation loop, the behavior of the regulation unit is studied using three-dimensional topological methods and by analog simulation. A prototype unit is under construction and its principal characteristics are given. The first tests involving self-instruction techniques are described for the cycling unit. Author (NSA)

N69-17681# Kyoto Univ. (Japan). Research Reactor Inst.
ROTATING TYPE OF NEUTRON BEAM MODULATING DEVICE
Yoshiaki Ishikawa, Fukada Minoru et al 26 Jul. 1967 51 p refs In JAPANESE; ENGLISH summary
(KURRI-TR-38) Avail: CFSTI

A neutron beam modulating device which modulates a neutron beam from a reactor thermal column sinusoidally by a rotating disc is described. This device can be used in neutron wave propagation experiments of thermal neutron systems and examples are given. NSA

N69-17686# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
PRECISE MEASUREMENT, IN THE SYMMETRIC MASS REGION, OF THE KINETIC ENERGY OF FRAGMENTS OF THERMAL FISSION OF U-235
M. Ribrag et al Jan. 1968 18 p refs Transl. into ENGLISH from Nucl. Phys., v. A99, 1967 p 41-54
(NP-tr-1707) Avail: CFSTI

Energy correlation experiments with fission fragments are strongly perturbed by false events in the symmetric region. It is shown that the measurement of an additional parameter, namely the difference in time-of-flight between the fragments, enables one to eliminate these difficulties. For thermal fission of ^{235}U, values of mass yields in the symmetric region are found to agree quantitatively with radiochemical values. Moreover, the average total kinetic energy as a function of the pre-neutron-emission mass has been calculated. This curve presents a large dip at symmetry with a maximum to minimum difference of 21.2 ± 0.8 MeV, which is smaller than previously published results. Author (NSA)

N69-17690# Kernforschungszentrum, Karlsruhe (West Germany).
URANIUM REACTION RATE MEASUREMENTS IN THE STEAM-COOLED FAST REACTOR SNEAK, ASSEMBLY 3A-2
R. Boehme and H. Seufert Jun. 1968 43 p refs Sponsored by US-Euratom Fast Reactor Exchange Program
(EURFNR-565; EUR-3970; KFK-811) Avail: CFSTI

Uranium reaction rate traverses as well as their fine structure have been measured at the Karlsruhe Fast Zero Power Reactor SNEAK assembly 3A-2. For this purpose U metal foils were irradiated in the reactor. The γ-X-ray coincidence technique was applied to determine the relative capture rates in ^{238}U. To get absolute rates by this method the counting equipment was calibrated by a ^{243}Am source. The relative fission rates were obtained by integral counting of the fission product γ-activity above 660 keV γ-energy. These rates were linked to an absolute parallel plate fission chamber experiment. The experimental rate ratios were compared with calculated ones. The traverse measurements indicate a strong dependency of the axial buckling (relative second derivative of the rates) on energy. The calculations with the Karlsruhe SNEAK-set yield these bucklings in the average 5% higher than measured. The calculated fission rate ratio $^{25}/^{28}$ is 13% to 20% lower than the measured one depending on the heterogeneity of the core, but the capture to fission rate ratio agrees better with the measurement. Author (NSA)

N69-17691# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorbauelemente.
THE STABILITY OF CONTROL TRACKS WITH RIGID FEEDBACK (UNCOMPENSATED) USING THE EXAMPLE OF THE STEAM-COOLED REACTOR
L. Krebs [1968] 25 p refs Transl. into ENGLISH from the German Rept. KFK-658 Sponsored by US-Euratom Fast Reactor Exchange Program
(EURFNR-495; KFK-656; EUR-3691) Avail: CFSTI

Stability limits of a steam cooled reactor are determined. Four coolant loop models are investigated; models considered are: with dead time, dead time and first order time lag, with and without dead time and n equal time lag constants, and with and without dead time and n different time lag constants. An example is used to illustrate the calculations. NSA

N69-17701*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIENCE WITH AND IMPROVEMENTS IN CONTAINMENT VESSEL PENETRATIONS
Charles W. Conant Washington Feb. 1969 19 p refs
(NASA-TM-X-1735) Avail: CFSTI CSCL 18J

Early containment vessel leak rate tests showed that potted electrical penetrations were a major contributor to the containment vessel leakage. This type of penetration was largely replaced with hermetic penetrations. Leak rate testing of the hermetic penetrations is done by the pressure decay method having a sensitivity better than 0.001 ft^3/day (2.8 × 10^{-5} m^3/day). The tests show that the average penetration leak rate is less than 0.003 ft^3/day (8.5 × 10^{-5} m^3/day). The use of hermetic penetrations has significantly reduced leakage through electrical penetrations, reduced maintenance, and reduced effort required to change cables penetrating the containment vessel. Author

N69-17787# Ente Nazionale per l Energia Elettrica (Enel), Latina (Italy).
RESULTS OF THE ENQUIRY INTO THE PROSPECTS FOR THE USE OF PLUTONIUM IN ENEL WATER REACTORS
A. Ariemma et al Washington AEC [1968] 49 p Transl. from Rept. Eur-3478
(Contract EURATOM-092-66-8-TEEI)
(AEC-tr-6946; EUR-3478) Avail: CFSTI

ENEL has begun a program on the prospects for using Pu in thermal reactors. It will be based on experimental studies in one of their own water reactors, either the Garigliano 160 MW(e) BWR reactor or the 300 MW(e) Trino Vercellese PWR reactor. Results of the physical, economic and safety studies made in order to act as a guide for the ENEL in choosing the reactor on which to concentrate subsequent studies and perform tests with a view to the use of Pu in regular reloads after 1971-1972 are presented. Author (NSA)

N69-17970# California Univ., Livermore. Lawrence Radiation Lab.
CONTROLLED THERMONUCLEAR RESEARCH Annual Report, Jul. 1967-Jun. 1968
T. K. Fowler et al 10 Jul. 1968 228 p refs
(Contract W-7405-ENG-48)
(UCRL-50002-68) Avail: CFSTI

Theoretical research is summarized for: mirror research; Astron research; toroidal design; and nonlinear dynamics. Research summaries are presented for plasma, vacuum, and surface physics; E-layer electron investigation; Levitron experiments; and basic plasma and atomic research. Summaries of the mechanical engineering development program are presented for the above research areas. Author (NSA)

N69-17975# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Jul. 1968
28 Aug. 1968 137 p refs
(Contract W-31-109-ENG-38)
(ANL-7478) Avail: CFSTI

Highlights of project activities are summarized for the month of July 1968. The EBR-2 was operated for 543 MWdt to conduct physics experiments related to the exchange of depleted uranium for stainless steel reflector subassemblies. Critical measurements were completed with ZPR-3 assemblies 52D and 52E and loading was started for 52F. Leak testing of ZPPR seal doors was continued, and cabling for experiments was installed. Plutonium and depleted uranium for the initial ZPPR core were received and stored. Nuclear safety studies, including TREAT operations, and chemical separations activities are discussed. NSA

N69-17984# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany). Institut fur Sondermetalle.
INVESTIGATION OF MECHANICAL PROPERTIES OF CERAMIC AND CERMET REACTION MATERIALS [ZUR UNTERSUCHUNG DER MECHANISCHEN EIGENSCHAFTEN VON KERAMISCHEN END METALLKERAMISCHEN REAKTORWERKSTOFFEN]
N. Claussen Jun. 1968 43 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-68-24) Avail:CFSTI

The diametral compression test can successfully be applied to ceramics and cermets. By means of this test, the theoretical basis of which is explained in detail, not only indirect tensile strength, but also Young's modulus and Poisson's ratio of some uranium compounds (UO_2, UN, UO_2–UN-mixtures), dispersions (UO_2–MgO, UO_2–Al_2O_3) and cermets (UO_2–Mo, UO_2–W, UN–Mo, UN–W) have been determined. Some theoretical and empirical strength-concentration relations are discussed. Author (NSA)

N69-18018# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL DATA ON SHIELDING ATTENUATION OF GAMMA-RADIATION OF EXTENDED SOURCES
D. P. Osanov 17 May 1968 24 p refs Transl. into ENGLISH from Vopr. Dozimetr. i Zashchity ot Izluchenii, Mosk. Inzh. Fiz. Inst. Sb. Statei (Moscow), no. 2, 1963 p 51–65
(AD-679515; FTD-MT-24-79-68) Avail: CFSTI CSCL 18/6

This paper presents results of experiments on the investigation of shielding attenuation of gamma radiation from solid, hollow, and gas filled cylindrical sources. The results are plotted in graphs. A number of measurements were made to determine the dependence of the multiple attenuation factor of gamma rays on the location of the shield between the source and the detector. TAB

N69-18060*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RADIATION PHYSICS RESEARCH AT MARSHALL SPACE FLIGHT CENTER
Russell D. Shelton *In its* Res. Achievements Rev., Vol. 2 1968 31 p refs (See N69-18059 07-34)
Avail: CFSTI CSCL 18

The status and scope of the radiation research program at Marshall Space Flight Center are described. The application of radiation to engineering problems and the effects of nuclear and space radiation on materials and components are discussed. Much of the progress made in the last year consists of the continued accumulation of engineering data. The Propulsion and Vehicle Engineering Laboratory has continued its testing of materials under reactor space radiation environments. The Astrionics Laboratory is concerned with the effects of radiation on electrical components and the development and calibration of instrumentation for the measurement of the radiation environment. The Research Projects Laboratory has been primarily concerned with the transport of radiation through shields and the aspects of radiation from the physical viewpoint. Appropriate contracts and publications in the field of radiation physics are referenced. Several applications of radiation for the solution of engineering problems are discussed briefly to indicate their feasibility and to provide contract and document references. Author

N69-18090# Brown, Boveri und Cie, A. G., Heidelberg (West Germany).
DEVELOPMENT OF EMITTERS FOR THERMIONIC FUEL RODS [ENTWICKLUNG VON EMITTERN FUER THERMIONISCHE REAKTOR-BRENNSTOFFELEMENTE]
P. Batzies, J. Demny, H. E. Schmid, and R. Zoeller Jun. 1968 71 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-68-25) Avail:CFSTI

To improve emitters for thermionic fuel rods of a thermal reactor, a fuel-emitter-system UO_2–Mo was studied in and out of pile and found to be thermodynamically and chemically stable. Mo-coated particles showed no increase in fission product-retention. To increase the efficiency of high work function surfaces, the needed production, preparation and examination technique was developed. W-(100)-vaporplating layers showed no change in work function by diffusion over long periods of time at elevated temperatures. The work functions of single and polycrystals were measured and gave literature compatible results, which will be used for comparison purposes in etching experiments. Author (NSA)

N69-18136# Gulf General Atomic, San Diego, Calif.
THE USE OF TRISCO COATED PARTICLES IN THE PSC REACTOR PLANT Summary Report
31 Jan. 1968 116 p refs
(Contract AT(04-3)-633)
(GA-8467) Avail: CFSTI

Topics discussed include: preparation and properties of vapor-deposited SiC; design of BISO–SiC (TRISO) coated particles; integrity of BISO–SiC (TRISO) coated particles; fission product retention of SiC; vapor pressure of Sr sorbed on graphite; effects of SiC on fission product inventories in Fort St. Vrain Power Reactor Unit 1; and effects of SiC on reactor design parameters. NSA

N69-18137# Battelle Memorial Inst., Columbus, Ohio.
AN EVALUATION OF THE APPLICABILITY OF EXISTING DATA TO THE ANALYTICAL DESCRIPTION OF A NUCLEAR-REACTOR ACCIDENT Quarterly Progress Report, Jul.–Sep. 1968
David L. Morrison, Wayne A. Carbiener, and Robert L. Ritzman 1 Oct. 1968 58 p refs
(Contract W-7405-ENG-92)
(BMI-1850) Avail: CFSTI

Methods of applying existing data to nuclear reactor accidents are summarized. Subjects covered are: (1) Zircaloy cladding, (2) pressurized-water reactors, (3) reactor safety, (4) reactor fuel elements, (5) uranium oxides, (6) steam corrosion, (7) heat transfer system, and (8) fission product containment. NSA

N69-18188# Gulf General Atomic, San Diego, Calif.
PSC REGION 1 FLOW MODEL (SERIES 2) TEST REPORT
W. E. Walker 8 Jul. 1968 90 p refs
(Contract AT(04-3)-633)
(CAMD-8625) Avail: CFSTI

The experimental rig used simulation of coolant gas flow in the Fort St. Vrain Power Reactor, Unit 1 core and steam generator is described; rig drawings are included. Gas velocity

profiles and temperature contour measurements are discussed; data are given in tabular and graphic form. NSA

N69-18193# United Nuclear Corp., Elmsford, N. Y. Research and Engineering Center.
FAST REACTOR MIXED-CARBIDE FUEL ELEMENT DEVELOPMENT PROGRAM. Quarterly Progress Report, Apr.-Jun. 1968
26 Sep. 1968 52 p
(Contract AT(30-1)-3415)
(UNC-5224; QPR-4) Avail: CFSTI

Research progress is summarized for the fast reactor mixed carbide fuel element development program. Specific areas of study include breeder reactors, reactor fuel elements, uranium and plutonium carbides, and plutonium and uranium oxides. NSA

N69-18247*# General Electric Co., Idaho Falls, Idaho. Nuclear Systems Programs.
CAVITY REACTOR CRITICAL EXPERIMENT. Progress Report, Period Ending 31 Jul. 1968
9 Aug. 1968 18 p ref
(NASA Order C-67747-A)
(NASA-CR-73950; Gemp-629) Avail: CFSTI CSCL 18I

A description of the critical core configuration is presented. Power maps from bare catcher foils are presented. The alterations for wave experiments are described. Power and flux maps for the altered configuration are presented. NSA

N69-18242# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NUCLEAR SAFETY. Quarterly Report, May-Jul. 1968
Oct. 1968 107 p refs
(Contract AT(45-1)-1830)
(BNWL-894) Avail: CFSTI

Research is reported on effects of temperature and pressure on reactor safety and leakage from pressurized water reactor containment structures; effects of spray chamber size on washout rate for methane; effects of size of spray columns on methyl iodide washout rate; configuration of a stainless steel failure detector for ultrasonic testing; solidification processes for radioactive wastes; and effects of cooling time on fission products in fast reactor irradiated fuels. NSA

N69-18243# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
ENGINEERING AND TEST BRANCH. Quarterly Technical Report, 1 Jan.-31 Mar. 1968
K. A. Dietz ed. Sep. 1968 97 p refs
(Contract AT(10-1)-205)
(IDO-17264) Avail: CFSTI

Research is reported on computer analysis of coolant loss accidents in pressurized water reactors; reactor safety experiments; coolant loss accident simulation in LOFT; design characteristics of analog reactor simulators; operating characteristics of LOFT centrifugal primary pumps; thermal properties of Zircaloy-4 clad uranium dioxide reactor fuel elements; distribution of iodine-131 and fission products in LOFT coolant loss accidents; acoustic filter performance simulation of PBF acoustic filters; and computer programs for depressurization rates and core hydraulic loads in pressurized water reactor subcooled region. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-17234# Institut Franco-Allemand de Recherches, St. Louis (France).
ON THE ACCURACY OF TEMPERATURE DETERMINATION FROM THE INTENSITY RATES OF Al LINES [ZUR GENAUIGKEIT DER TEMPERATURBESTIMMUNG AUS DEM INTENSITAETSVERHAELTNIS VON Al-LINIEN]
H. Mach 9 Aug. 1967 27 p refs In GERMAN
(ISL-T-32/67) Avail: CFSTI

Intensity correlations between 3963/44 Å and 3092/82 Å lines of the aluminum spectra were used to develop mathematical formulas for exact determination of emission temperatures in optical thin and optical thick Al layers. Emphasis was placed on effects of oscillator strengths. A 10% accuracy was obtained for thin layers at 4000°K temperature. Emission from optical thick layers showed Van-der-Waal effects and resonance effects in line widening of optical thick layers were found. A 10% to 15% accuracy was obtained for the latter case. Transl. by G.G.

N69-17237# Institut Franco-Allemand de Recherches, St. Louis (France).
CALCULATION OF THE ACCELERATION OF A PROJECTILE IN THE TUBE FROM SPACE-TIME WIRELESS MEASURES [BERECHNUNG DER GESCHOSSBESCHLEUNIGUNG IM ROHR AUS RADIOELEKTRISCHEN WEG-ZEIT-MESSUNGEN]
M. Koenig, G. Krauth, R. Laumann, and G. Schultze 27 Feb. 1967 40 p refs In GERMAN
(ISL-N-1/67) Avail: CFSTI

Doppler radar measurements on projectile speed inside cannon barrels were obtained by photoregistration and evaluated for their time-velocity relationships. Differential analysis and least square methods established a velocity maximum of ± 10,000 m/s^2 for a 3 cm cannon projectile at Doppler frequency of 3 cm. Transl. by G.G.

N69-17298# Institut Franco-Allemand de Recherches, St. Louis (France).
PRODUCTION OF SHORT LIVED, INTENSIVE LIGHT IMPULSES [ERZEUGUNG KURZZEITIGER, INTENSIVER LICHTIMPULSE]
L. Repper 3 May 1967 19 p refs In GERMAN
(ISL-N-20/67) Avail: CFSTI

Production methods for short lived intensive light impulses are discussed with emphasis on condenser discharge over gaseous spark gaps. The transformation velocity of the condenser's electric energy during discharge and the gaseous afterglow determine the spark duration. It is proposed to study spark duration and wave length interdependence; expected results should show that a decreasing wave length shortens spark duration. Transl. by G.G.

N69-17300# Institut Franco-Allemand de Recherches, St. Louis (France).
OPTICAL TRANSMISSION OF A POINT OF RADIOLOGICAL SHIELDING THROUGH A TWO LENS SYSTEM [TRANSMISSION OPTIQUE D'UN POINT D'ECRAN RADIOLOGIQUE A TRAVERS UN SYSTEME DE DEUX LENTILLES]

J. P. Decamps and L. Oudin 8 Aug. 1967 32 p In FRENCH (ISL-T-36/67) Avail: CFSTI

Design calculations were developed for an optical lens system to protect sensitive equipment (picture amplifiers) from shock waves originating in the observation room. Emphasis was placed on adequate picture quality at minimal loss of light. Transmission gradients between picture and object were calculated point by point. Diffraction patterns caused by diaphragm rim, aberrations, and loss of light during filtering through the lens were disregarded. A fast graphical method allowed the approximate determination of system dimensions with the desired degrees of transmission efficiency, enlargement, lense aperture, etc. Transl. by G.G.

N69-17450# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON POLARIZED LUMINESCENCE OF COLORED CRYSTALS

V. L. Vinetskiy et al 2 Feb. 1968 10 p refs Transl. into ENGLISH from Opt. i Spektroskopiya (Moscow), v. 4, no. 1 p 60-65

(AD-679711; FTD-HT-23-1288-67) Avail: CFSTI CSCL 20/2

Optical transitions of F sub 2 and F+ sub 2 centers into different excited states are discussed. It was shown that at least two absorption bands of light of more or less equal intensity correspond to each of these centers. A quantum-mechanical interpretation is given of the experimentally observed azimuth dependence of the degree of polarization of luminescence in the case of excitation by polarized light from the region of absorption of the color centers. Author (TAB)

N69-17617# San Fernando Valley State Coll., Northridge, Calif.

ANALYTICAL STUDIES PERTAINING TO THE MEASUREMENT OF LIGHT ABSORPTION IN AIR Final Report, 1 Feb. 1966-31 Aug. 1968

Bela A. Lengyel and R. J. Romagnoli 30 Oct. 1968 71 p refs (Contract N00014-66-C-0098; ARPA Order 306; Proj. DEFENDER) (AD-679590) Avail: CFSTI CSCL 20/5

Experimental methods proposed for the measurement of the absorption coefficient of light in air are analyzed. The calculations are primarily intended for the wavelength region where, for certain wavelengths, the absorption coefficient to be measured is estimated to be of the order of .000000001 per cm. The effects of scattering, heat conduction, static and acoustic pressure variations are examined and are related to the problem of detecting the signals produced by the absorption of heat from the laser beam. Both pulsed and cw schemes are considered. The measurement of the static pressure rise in a narrow tube appears as a feasible, although marginal method which offers some hope of success. Also, an interferometric method appears feasible. Finally, the absorption coefficient of the 10.6 micron carbon dioxide laser beam was measured in air. Author (TAB)

N69-17632 Colorado Univ., Boulder.

AN INVESTIGATION OF ELECTROMAGNETIC WAVE PROPAGATION OVER INHOMOGENEOUS GROUND

Gerard Alan Schlak (Ph.D. Thesis) 1967 422 p

Avail: Univ. Microfilms: HC $19.15/Microfilm $5.40 Order No. 68-10582

This study concerns the behavior of the ground wave launched at low frequency by a vertical electric Hertzian dipole above a horizontally stratified half-space and above a wedge-shaped subsurface region. The theoretical treatment of the ground wave behavior above a stratified half-space is given by two asymptotic solutions. The first solution is that obtained by J. R. Wait, and it applies when the surface impedance is small in comparison to the intrinsic impedance of free space. The second solution is presented here for the first time. It is based upon a suggestion of J. R. Wait, and it applies when the surface impedance is not small. To supplement the analytical work, numerical calculations were made using a digital computer, and graphs of the results are presented. Graphs are given which show the behavior of the surface impedance above certain stratified regions. Dissert. Abstr.

N69-17633 Princeton Univ., N. J.

INTENSITY MODULATION OF TRANSMITTED LIGHT AT THE GROUND STATE HYPERFINE FREQUENCY OF K-39

Arthur Herbert Firester (Ph.D. Thesis) 1967 105 p

Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-8923

This paper discusses intensity modulation of transmitted light at 462 MHz, due to coherence between sublevels of the K^{39} ground state. A concise theory of transmitted light modulation is presented, using the density matrix and monitoring operator formalism. The theory and construction of an ultra-high frequency photodetection system is described. The auxiliary apparatus is also described, together with experimental conditions under which signals have been observed. It is suggested that a possible application of this technique is a wide range magnetometer. Dissert. Abstr.

N69-17660# Naval Research Lab., Washington, D. C.

SYSTEMATIC ERRORS IN ULTRASONIC PROPAGATION PARAMETER MEASUREMENTS. PART 4—EFFECT OF FINITE THICKNESS ELASTIC SOLID TUBES ENCLOSING THE LIQUID CYLINDER OF INTEREST

Vincent A. Del Grosso (Ph.D. Thesis) Nov. 1968 144 p refs (AD-679673; NRL-6852) Avail: CFSTI CSCL 20/1

The exact formulation of the characteristic or frequency equation for an inviscid liquid cylinder radially enclosed within a finite impedance elastic solid of finite wall thickness is solved for the permissible modes, including degenerations to the surrounding medium being of infinite extent and either an elastic solid or another liquid, as well as to the limiting cases of infinite impedance (rigid boundary) and zero impedance (free boundary). These modes are utilized to expand both the potential within the otherwise unterminated cylinder and the source impedance variation with position of an opposing termination. A piston source of appreciable ka (=100 pi) is found to render further source specification indifferent as to uniform pressure or uniform velocity, and a large radial impedance mismatch (=28) is found to permit a simplifying orthogonality assumption. With the inviscid assumption, the formulation indicates that a judicious selection of experimental configuration can limit diffraction propagation uncertainties to a few parts per million. An incidental result is the demonstration that the zero elastic tube mode exists at all frequencies rather than displaying an upper cutoff frequency as was recently reported. Author (TAB)

N69-17775 Ohio State Univ., Columbus.

THE FAR INFRARED OPTICAL PROPERTIES OF KCl AND KBr

Kenneth William Johnson (Ph.D. Thesis) 1967 152 p

Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-8843

The far infrared optical properties of KCl and KBr were measured at T = 300°K to determine the real and imaginary parts of the complex index of refraction. The experimental measurements were made in reflection with a far infrared Michelson interferometer operating in an asymmetric mode. The amplitude and phase of the reflectance were measured from 40 cm^{-1} to 360 cm^{-1}. From the reflectance data the real and imaginary parts of the complex index of refraction were obtained. A theoretical expression for the dielectric susceptibility tensor was obtained by evaluating the ensemble average of the electric dipole moment operator, which was linear in the ionic displacements. The susceptibility tensor was obtained in terms of the proper self-energy matrix of the $\underline{k} = 0$ phonon mode. The frequency dependent Hermitean and

anti-Hermitean parts of the KCl self-energy matrix were numerically calculated by an electronic computer by using the eigenvalues and eigenvectors for one thousand wave vectors that were evenly-distributed throughout the first Brillouin zone. Dissert. Abstr.

N69-17850# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.
ANALYSIS OF WAVE PROPAGATION IN A NONLINEAR STRAIN HARDENING MEDIUM
R. C. Shieh Sep. 1968 39 p refs
(Contract DASA01-68-C-0017)
(AD-679653; DASA-2164) Avail: CFSTI CSCL 20/11

The paper is concerned with the propagation of plastic waves of uniaxial strain across an infinite, nonlinear, strain-hardening slab of finite thickness that is free at one surface and subjected, at the other, to a suddenly applied compressive stress, which thereafter is maintained constant or decreased monotonically to zero. In loading, the stress-strain diagram of the material for uniaxial strain is supposed to consist of a rectilinear segment followed by a curve that is convex toward the strain-axis. In unloading, the strain is supposed to remain constant (rigid unloading). General expressions for stress, strain, and particle velocity are derived, together with the governing integro-differential equation for the shock path. Closed-form solutions are obtained for two cases. In the first, the suddenly applied stress is thereafter maintained constant, and the curved part of the stress-strain diagram for loading is described by a power law. In the second case, the suddenly applied stress is monotonically reduced to zero, and the stress-strain diagram for loading consists of two straight segments. Finally, a semi-inverse method for obtaining closed-form solutions is developed in which the applied stress is treated as a function of the shock path so that the determination of its explicit variation with time is a part of the solution of the problem. Author (TAB)

N69-17883 Michigan State Univ., East Lansing.
MEASUREMENT OF THE VELOCITY OF SOUND IN WATER BY OPTICAL METHODS
Arthur Jared Crandall (Ph.D. Thesis) 1967 63 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-7882

Several new optical methods have been developed for the measurement of sound velocities in transparent fluids. The visibility pattern from stationary, progressive and pulsed progressive waves are detected by a fast response photomultiplier tube rather than visually, which allows the use of lower sound intensities. A theoretical expression is developed for the errors caused by diffraction in the near field of a circular transducer. The velocity of sound in distilled water was measured to be 1517.70 ± .20 m/sec. at a temperature of 34.00°C. Dissert. Abstr.

N69-17885# Milan Univ., (Italy).
TONIC THERMOCONDUCTIVITY AND PROPERTIES OF DIELECTRICS Final Scientific Report, 1 Oct. 1964–31 Jan. 1968
S. Benci, C. Bucci, R. Carpelletti, R. Fieschi, and C. Paracchini Jul. 1968 101 p refs Prepared in cooperation with Parma Univ.
(Grant AF-EOAR-07-85)
(AD-679609; AFOSR-68-2768) Avail: CFSTI CSCL 20/2

The research performed dealt mainly with the dielectric and optical properties of pure and doped alkali halides single crystals; other dielectric materials such as CaCO3, Al2O3 etc. were studied as well, but the results obtained are only qualitative. The properties of metal impurities, color centers, electron traps were studied extensively; some of the results deal with the influence of plastic deformation and with the properties of ionic space charge. Author (TAB)

N69-18005 Columbia Univ., New York.
THE EFFECTS OF TARGET AREA AND LUMINANCE ON GRATING ACUITY
Joel Myron Pokorny (Ph.D. Thesis) 1967 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 67-15512

Acuity thresholds were determined in narrow-band chromatic illumination for gratings subtending square targets from 6 to 144 minutes of visual angle along each side. In 675 nm illumination with a) increasing luminance at maximal contrast, and b) increasing contrast at constant luminance, acuity increases as target width increases up to a critical target width beyond which further increases in target size have no effect on acuity. As peak-to-peak luminance within the target increases, the critical target width decreases. In 465 nm illumination critical target widths can only be defined at high luminance levels. Acuity increases as the critical target width decreases, and does not follow an isofrequency line, i.e. locus of points at which a constant number of bars always appears within the critical target area. Rather, fewer bars appear in the field at threshold as the critical target width decreases. Area-luminance relations were derived for fixed acuity levels. For all conditions of the study, as target area was increased, the necessary luminance for a given acuity decreased. Further, as the luminance was increased, the summation area (range within which area luminance summation occurred) decreased. Dissert. Abstr.

N69-18026*# Atomics International, Canoga Park, Calif.
DEVELOPMENT OF A SUPERCONDUCTIVE INDUCTANCE TYPE HIGH ENERGY DENSITY STORAGE SYSTEM
D. E. Spiel and R. W. Boom 30 Aug. 1968 73 p refs
(Contract NAS8-11907)
(NASA-CR-98298; AI-68-108; TR-4) Avail: CFSTI CSCL 09A

The initial goal was to store 10^4 joules in a superconducting magnet which had been charged by a flux pump. The energy was to be discharged at 5 kilocycles into a magnetic hammer, with the first oscillatory peak in the discharge current to be 20,000 amperes. The flux pump and magnet have been constructed and have undergone initial tests. The pump is a modified full-wave rectifier type with a designed average output of 100 watts. The magnet is 27 turns of 1-in.-diam composite cable forming a solenoid 5 in. ID, 13 in. OD, and 7 in. long with only 60 ft of cable. The magnet and connectors are capable of carrying in excess of 20,000 amperes. The unit weighs about 150 lb, is 40 in. high, and about 13-1/2 in. in diameter. Full immersion in liquid helium has never been accomplished due to a faulty dewar; thus in all tests, parts of the magnet or flux pump were cooled by conduction or by off-gas only. Under these conditions, 8000 amperes and 3000 joules have been pumped and stored. Author

N69-18088 Florida State Univ., Tallahassee.
TIME DEPENDENT BEHAVIOR OF FREE ELECTROMAGNETIC FIELDS INCLUDING SELF-GRAVITATING EFFECTS
John Stuart Wallingford (Ph.D. Thesis) 1967 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-7603

The detailed time dependent behavior of the decay of the electromagnetic field after the current producing it has been quickly turned off is found and described (graphed). The cases of a current in a long straight wire and a current in a long straight solenoid are considered. Although it is frequently said that the field collapses, it is shown here that its behavior would be more accurately described by saying that it explodes. The fields are initially obtained by solving the classical Maxwell equations. The analytical methods necessary to obtain a solution are considered in detail. The use of the CDC 6400 digital computer to evaluate and display the solutions is discussed. The influence of general relativistic or gravitational effects is then considered. The exact static solutions to the Einstein–Maxwell system of equations, in terms of the current and conductor dimensions are found. Deviations from the purely

Maxwellian field are discussed. The magnitude of these deviations indicate that general relativistic effects have a negligible influence on the time dependent behavior of the free electromagnetic fields due to physically realizable currents. Dissert. Abstr.

N69-18104*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL STUDIES OF REFLECTED SOLAR ENERGY FIELDS, RED TIDE, KELP 0.68 TO 2.4 MICRONS C-47 AIRCRAFT
W. A. Hovis Nov. 1968 145 p refs
(NASA-TM-X-63404; X-622-68-451) Avail: CFSTI CSCL 20F

As part of a program to determine the spectral distribution of reflected solar energy from natural surfaces measurements were made, over a variety of surfaces, with a down-looking spectrometer mounted in a C-47 aircraft. Of particular interest was the magnitude of energy reflected from vegetation, both marine and terrestrial, in the spectral interval 0.7 to 1.3 microns. It is well known that chlorophyll-bearing vegetation has a strong reflectance feature in that spectral interval, and since the Nimbus B-2 High Resolution Infrared Radiometer has a channel responding to radiation in the interval from 0.7 to 1.3 microns the question arose as to what degree fields of green vegetation might be confused with clouds, also a strong reflector from 0.7 to 1.3 microns. A previous flight, on the NASA Convair 990 jet aircraft, over the Yucatan Jungle of Mexico showed that jungles were rather poor reflectors, but the question of cultivated fields and marine vegetation remained unanswered. The data presented here do not, of course, present a complete answer, but they at least allow the magnitude of the problem to be estimated. Author

N69-18223# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
RECENT MEASUREMENTS OF JET AND COMPRESSOR NOISE [RE CENTES MESURES DE BRUIT DE JETS ET DE COMPRESSEURS]
Michel Kobrynski 1968 12 p refs In FRENCH; ENGLISH summary Presented at the 6th Intern. Congr. of Aeron. Sci., Munich, Sep. 1968 Submitted for publication
(ONERA-TP-602) Avail: CFSTI

Echoless rooms with air and gas intakes and exhaust pipes, as well as open-air test benches were constructed for these researches. Experiments were carried out on jet and compressor models and on turbojets, either on test benches or in aircraft on the ground or in-flight. The results gave rise to a method of computing the sound field on the ground. Several model silencers were developed and some are being studied for the Concorde. Experiments on compressors have shown the fine structure of the noise spectrum, the effect of some of the parameters on sound mission and their relationship with the emitted acoustic power. Author (ESRO)

N69-18235# Reading Univ. (England).
MULTILAYER FILTERS FOR THE REGION 0.8 TO 100 MICRONS. VOLUME 1: TEXT AND TABLES Final Scientific Report, 1 Nov. 1964–7 May 1968
S. D. Smith and J. S. Seeley 7 May 1968 197 p refs
(Contract AF 61(052)-833; Proj. Vela-Uniform)
(AD-679564; AFCRL-68-0496-Vol-1) Avail: CFSTI CSCL 20/6

A study of materials for multilayer evaporated film filters for the region 1-100 microns has yielded several successful high index-low index combinations, notably PbTe/ZnS (5 - 25 microns) and Ge/CaI (10 - 80 microns). Author (TAB)

N69-18236# Reading Univ. (England).
MULTILAYER FILTERS FOR THE REGION 0.8 TO 100 MICRONS. VOLUME 2: ILLUSTRATIONS Final Scientific Report, 1 Nov. 1964–7 May 1968
S. D. Smith and J. S. Seeley 7 May 1968 157 p
(Contract AF 61(052)-833; Proj. Vela-Uniform)
(AD-679565; AFCRL-68-0496-Vol-2) Avail: CFSTI CSCL 20/6

Graphs, plots, and photographs are presented to illustrate the performance characteristics of the various multilayer filters. For abstract see N69-18235.

N69-18272 Michigan Univ., Ann Arbor.
CONVERSION ELECTRON SPECTRA: A LINE SHAPE ANALYSIS FOR PERMANENT MAGNET SPECTROGRAPHS
Cecil Gerald Diethrich (Ph.D. Thesis) 1967 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-7582

The first goal of this study was an understanding of the factors which determine the shape of spectral lines produced in permanent magnet beta spectrographs. Computer programs were written to provide a complete three-dimensional solution involving none of the approximations of earlier line shape studies, and a CRT display was used for a thorough examination of a wide range of effects. The result is a detailed knowledge of exactly how theoretical line shapes are affected by variations in the spectrograph parameters. Information obtained from the line shape study was next applied in redesigning the spectrograph camera. A rarely used configuration was adopted on the basis of the previous analysis. Local corrections of the three existing permanent mangets were made to ensure field uniformity to better than 0.1%. The redesigned spectrograph was used for a study of the internal conversion lines in the decay of ^{109}Cd after a curved-crystal spectrometer measurement of the γ-transition energy. Dissert. Abstr.

N69-18279 Illinois Univ., Urbana.
SCALING LAWS AND CORRELATION FUNCTIONS NEAR MAGNETIC CRITICAL POINTS
Robert Joseph Hecht (Ph.D. Thesis) 1967 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-8105

Critical point phenomena in magnetic systems are studied with the aid of the scaling laws. These laws relate the critical indices which describe the behavior of thermodynic and correlation functions near T_c. An experimental survey of ferromagnetic and antiferromagnetic data near T_c, is presented. Susceptibility, correlation length, magnetization, specific heat and a magnetic equation of state are discussed. The scaling law theory is extended to predict the temperature, field and spatial dependence of various spin correlation functions. These predictions are checked by analytic calculations for the two-dimensional Ising model in zero field. Results are presented for the energy density-energy density and energy density-spin correlation functions in the limit $\epsilon << 1$, $R >> 1$, but the product ϵR arbitrary. Results are also presented for a group of two, three and four spin correlations at T_c. In each case the scaling law predictions are verified. Dissert. Abstr.

N69-18300#
INVESTIGATIONS OF TURBULENCE BY OPTICAL METHODS
N. F. Derevianko et al [1968] 17 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekh. Fiz. (USSR), no. 4, 1968 p 105–116
Avail: CFSTI

The application of optical methods to measure turbulence characteristics of fluid, gas, or plasma flows is reviewed. The review deals with the findings of other authors. Theoretical and practical aspects of diffusion methods, densitometer methods, and anemometer methods are briefly discussed. K.W.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-17203# Muenster Univ. (West Germany). Institut fuer Theoretische Physik.

AN EXAMPLE OF THE INFLUENCE OF THE MASS OPERATORS IN THE BHABHA EQUATION [EIN BEISPIEL FUER DEN EINFLUSS DES MASSE-OPERATORS IN DER BHABHA-GLEICHUNG]

R. Stoeve Jun. 1968 8 p refs In GERMAN
(BMwF-FBK-68-26) Avail: CFSTI

The quantity κ in the Bhabha equation $(\partial_k\beta_k + \kappa)\psi = 0$ is a Lorentz invariant operator. With suitably chosen commutators (β_k, β_l) the operator β_k and the nucleus of the Lorentz group span a Lie algebra, in the adjoint representation of which the Bhabha equation with special κ describes the electromagnetic field. Author (NSA)

N69-17207# Oak Ridge National Lab., Tenn.

DETERMINATION OF DIFFUSION COEFFICIENTS OF THERMAL ELECTRONS WITH A TIME-OF-FLIGHT SWARM EXPERIMENT

De Vaughn Raymond Nelson and F. J. Davis (Ph.D. Thesis—Tenn Univ., Knoxville) Nov. 1968 164 p refs
(Contract W-7405-Eng-26)
(ORNL-TM-2222) Avail: CFSTI

A typical time-of-flight electron swarm experiment was modified by replacing the electric field-ring assembly with a conducting paper cylinder in order to (1) increase the lateral dimension of the swarm region, and (2) remove nonconducting surfaces which become charged with electrons and thereby provide the zero-field condition necessary for thermal electron diffusion and capture studies in gases. A new drift-dwell-drift technique was devised whereby electron swarms were (1) drifted to the center of the swarm region, (2) allowed to dwell there for varying periods of time under field-free conditions, and then (3) drifted to the anode where proper sampling with a differentially pumped electron multiplier detection system allowed the reconstruction of the swarm time-of-arrival distribution. Diffusion coefficients were determined for thermal electron swarms in nine gases. Author (NSA)

N69-17208# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

RELATIVISTIC THREE DIMENSIONAL EQUATIONS FOR THE TWO BODY PROBLEM IN THE UNEQUAL MASS CASE

V. G. Kadyshevskii, M. D. Mateev, and R. M. Mir-Kasimov 1968 22 p refs
(JINR-E2-4030) Avail: CFSTI

Three-dimensional relativistic equations of quasipotential type were obtained for a system of two particles with masses m_1 and m_2. These equations are generalizations of the corresponding Lippmann–Schwinger and Schrödinger equations in the spirit of a Lobachevsky geometry, realized on the hyperboloid $p^2_0 - \vec{p}^2 = m_1 m_2$. The concept of relativistic relative momentum, expressed in terms of the reduced mass and the relativistic relative velocity of the particles, plays an improtant role. Author (NSA)

N69-17210# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

MULTI-STEP STRIPPING ON DEFORMED NUCLEI

V. K. Luk'yanov and I. Zh. Petkov 1968 9 p refs Submitted for publication
(JINR-E4-4015) Avail: CFSTI

The expression for the stripping cross section on deformed nuclei was analyzed. Using the diffraction approximation, the multi-step character of the (d,p) stripping reaction is revealed. As an example, the reaction ^{24}Mg(d,p)^{25}Mg with transition to the levels 5/2 +(g.s.) and 7/2 +(1.61 MeV) is considered. Author (NSA)

N69-17219# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

PATHS AND IONIZATION LOSSES OF THE PROTON ENERGY IN DIFFERENT MATTERS

I. M. Vasilevskii, I. I. Karpov, V. I. Petrukhin, and Yu. D. Prokoshkin 1968 27 p refs In RUSSIAN Submitted for publication
(JINR-P1-4081) Avail: CFSTI

By the Bragg curve method of 660-MeV proton paths in C, Al, Cu, and Pb are measured. By using the differential ionization chamber the relative ionization losses of the proton energy are determined for different matters in the energy range 100 to 600 MeV. The experimental results are in agreement with the theoretical values at the ionization potentials equal to I_C=(82.5 ± 1.3) eV, I_{Al} = 160 eV, I_{Cu} = (323 ±5) eV, I_{Sn} = (518 ±13) eV, I_{Pb} = (826 ±14) eV. Author (NSA)

N69-17220 Illinois Univ., Urbana.

He^3 INDUCED REACTIONS IN IN Li^6 AND Li^7

Van Fonken Wilford Bluemel (Ph.D. Thesis) 1967 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-8026

The Li^6 and Li^7 targets were bombarded by He^3 particles at 21.2, 24.5, and 28.8 MeV. A solid-state-detector telescope detected He^3 and α particles, plus some tritons, coming from the target. The forms of the angular distributions were characteristic of direct interaction processes. Angular distributions of several reactions were measured. Each reaction is discussed, and the angular distributions are compared with appropriate experimental results from other laboratories. A possible approach to interpreting the data is suggested. Dissert. Abstr.

N69-17221 Florida State Univ., Tallahassee.

THE GROUND STATE OF Li7 AND Be7

Walter Jackson McClure (Ph.D. Thesis) 1967 51 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-7794

The ground state energies and wave functions of ^{7}Li and ^{7}Be and certain related energies are calculated by a variational method using cluster trial functions and realistic two-nucleon central exchange forces with repulsive core. Despite rough approximations in treating short-range correlations, fair agreement with experiment is obtained. The effect of the Coulomb force on the wave functions of these mirror nuclei is also discussed. Dissert. Abstr.

N69-17251# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

INTEGRAL REPRESENTATIONS OF VACUUM EXPECTATION VALUES WITH ACCOUNT FOR LOCAL COMMUTATIVITY

V. P. Gachok 1968 20 p refs
(ITF-68-18) Avail: CFSTI

A review is given of the author's works dealing with the problem of moments in quantum field theory. The problems of constructing a commutative algebra of operators associated with a given Wightman functional is discussed. The latter can be done in two cases, namely: in the case of the Euclidean quantum theory and in the case for which the condition of positive definiteness is valid in the domain of completely spatially divided vectors. The lecture is supplied with appendices where the examples are given of the adopted condition of positive definiteness being valid. Author (NSA)

N69-17252 Ohio State Univ., Columbus.
A WAVE-RADIATION MODEL FOR THE ONSET OF DISSIPATION IN SUPERFLUID HELIUM AT THE ROTON CRITICAL VELOCITY
Edward Harold Takken (Ph.D. Thesis) 1967 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-8888

This model is a classical, correspondence-principle-limit point of view and is quite analogous to the classical description that is widely accepted for understanding the emission of photons by an electric charge that moves at a constant velocity greater than the speed of light in a dielectric medium. After first deriving a theory for the wave excitations and boundary value problems of the correspondence principle limit for a condensed-boson system, this paper shows that a wave radiation field forms around a foreign body moving through the superfluid medium when the body moves faster than the minimum phase velocity, $(\omega/k)_{min}$, of wave excitations in the medium. Moreover, the spatial dependence of this wave field and the loss of energy radiating through it are calculated as functions of the fractional increase of the foreign body's velocity above the threshold velocity $(\omega/k)_{min}$. In spite of approximations made in the calculations, the results indicate that it is impossible, experimentally, to force an ion complex to move through the superfluid component of helium at a velocity observably greater than the roton critical velocity. Dissert. Abstr.

N69-17267 Washington Univ., Seattle.
APPROXIMATE SOLUTIONS OF THE BETHE-SALPETER EQUATION AT LOW ENERGIES
John Henry Connell (Ph.D. Thesis) 1967 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-9267

A method of finding successive approximations to the solution of the Bethe–Salpeter equation for low energy interactions is described. It is based upon work of Blankenbecler and Sugar and can be applied to nucleon–nucleon interactions. The method works because of the good accuracy of potential theory in interactions of this type. Potential theory is defined by the method and its validity and limitations are described. Elementary applications of the method to the Wick–Cutkosky and QED Bethe–Salpeter equations are given. The wave functions of the method presented are related to those of the usual potential theory in a simple manner. (Also, two side results are included about the QED electron-position Bethe–Salpeter equation in the ladder approximation with arbitrary covariant gauge constant. (1) The iteration solution to the equation converges when the total center of mass energy lies in a certain domain of the complex plane which includes zero. (2) The equation can be written as a second order partial differential equation in momentum space.) Dissert. Abstr.

N69-17268 New York Univ., N.Y.
PERTURBATION OF THE POLES OF THE SCATTERING MATRIX
James A. La Vita (Ph.D. Theory) 1967 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10074

The change in the position of the poles of the scattering matrix due to changes in the shape of the scattering obstacle is examined. Use is made of the scattering theory in which the poles appear as eigenvalues of a closed operator whose resolvent is the product of the resolvent of a differential operator and certain projections which are independent of the obstacle. This makes it possible to employ a suitable modification of the methods used by Rellich, Kato and Garabedian–Schiffer for perturbation problems of eigenvalues of partial differential equations. It was proven that for a one parameter family of obstacles depending analytically on the parameter all poles of the scattering matrix depend algebraically on the parameter. An explicit formula for the first variation is derived in the case of simple eigenvalues. Implicit in the dependence theorem is the existence of poles perturbed from a known case, namely the sphere. This strengthens the indication that one would expect the existence of poles in general. Dissert. Abstr.

N69-17280 Pennsylvania Univ., Philadelphia.
THE PARITY-VIOLATING INTERNUCLEON POTENTIAL
Ephraim Samuel Fischbach (Ph.D. Thesis) 1967 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-9197

The parity-violating internucleon potential, $v(r)_{12}$, induced by the weak interactions is derived and analyzed. It is shown how the matrix elements of the weak parity-violating Lagrangian density may be expressed in terms of products of one-hadron – one-hadron matrix elements of the strangeness-conserving hadronic weak currents $V_\lambda(x)$ and $A_\lambda(x)$, and how these matrix elements can be evaluated using CVC and PCAC. Off-mass-shell effects at the weak interaction and strong interaction vertices are considered in some detail. The one-pion-exchange contribution to $v(r)_{12}$ at low energies because of its long range, is analyzed in particular detail by use of a dynamical model of the weak NNπ vertex. The contribution of ρ-meson exchange is also discussed. Dissert. Abstr.

N69-17282# Kyoto Univ. (Japan). Research Reactor Inst.
MEASUREMENT OF FAST NEUTRON SPECTRA BY THRESHOLD DETECTORS
Itsuro Kimura, Katsuhei Kobayashi et al. 1967 35 p refs In JAPANESE
(KURRI-TR-27) Avail: CFSTI

Methods of measurement of the fast neutron spectra, using threshold reaction foils, are first reviewed. A procedure is proposed of expanding the unknown spectrum by the associated Laguerre polynomials with the experimental formula for fission spectrum as the first term. Then, it is calculated how the nuclear fission spectra and the four transformed spectra, using ^{115}In (n,n'), ^{32}S(n,p), ^{58}Ni(n,p), ^{27}Al(n,α), ^{27}Al(n,p), ^{24}Mg(n,p), ^{56}Fe(n,p), can be reproduced. It was shown that the Laguerre polynomials expansion method is far superior to the other methods. Finally, using the procedure, the fast neutron spectrum in the E-3 experimental hole of the Kyoto Univ. Reactor is obtained and compared with other methods. Author (NSA)

N69-17307# Akademiya Nauk URSR. Kiev. Inst. Teoreticheskoi Fiziki.
NONLOCAL QUANTUM THEORY OF SCALAR FIELD. 1: LOCAL AND NONLOCAL GENERALIZED FUNCTIONS
G. V. Efimov 1968 68 p refs In RUSSIAN
(ITF-68-52) Avail: CFSTI

The space-time properties of the generalized functions are studied for various sequences of the coefficients C_n. A practicable role of this class of generalized functions in the construction of the nonlocal quantum field theory is investigated. Author (NSA)

N69-17308# Akademiya Nauk URSR. Kiev. Institut Teoreticheskoi Fiziki.
GENERAL PROPERTIES OF THE TWO-POINT FUNCTION AND INVALIDITY OF THE TCP-THEOREM FOR INFINITE-COMPONENT FIELDS
I. T. Todorov 1968 20 p refs
(ITF-68-60) Avail: CFSTI

A concise review is given of recent work by A. I. Oksak, R. P. Zaikov and the author on general properties of the two-point function, valid for infinite-component fields. A spectral representation of the two-point function is found which takes into account Lorentz invariance and spectrum conditions. It includes a decomposition of the spectral density with respect to spin. The consequences of locality are studied by means of Bogolyubov–Vladimirov's theorem.

Examples are constructed showing that locality does not lead automatically to TCP-invariance and that TCP does not imply even weak local (anti-) commutativity in a theory involving infinite-component fields. Author (NSA)

N69-17309# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
AUTOMATION OF A NUCLEAR EXPERIMENT ON THE 4-MeV ELECTROSTATIC ACCELERATOR OF THE FTI OF THE ACADEMY OF SCIENCES, USSR, PART 2
V. A. Yamitskii, E. G. Kopanets, Yu. S. Korda, S. P. Tsytko, and P. M. Zeidlits 1967 97 p refs In RUSSIAN
(NP-17612) Avail: CFSTI

The selection rules for electric and magnetic transitions are presented in summarized form for the single-particle approximation and for the generalized model of the nucleus. The photoefficiency of a NaI crystal is analyzed mathematically by a Monte Carlo method and the theoretical results are compared with experimental values. Experimental pulse distributions are analyzed on the Dnepr digital computer after suitable mathematical treatment and programming of the subject. Complex gamma spectra are resolved according to the areas under the peaks. Experimental results are given for the $^{26}Mg(p,\gamma)^{27}Al$ reaction at E_p = 2293 and 2322 keV. Details of the program used on the computer are given. NSA

N69-17310# Oak Ridge National Lab., Tenn.
THE Sn-117, 119 (p,n) Sb-117 119 REACTIONS NEAR O + ANALOGUE STATES
Robert Lee Kernell (Ph.D. Thesis—Tenn. Univ., Knoxville) Oct. 1968 119 p refs
(Contract W-7405-Eng-26)
(ORNL-TM-2339) Avail: CFSTI

The $^{117,119}Sn(p,n)^{117,119}Sb$ reactions were investigated in the vicinity (Ep ≈ 4.5 MeV) of the 0+ analogue states in the compound nuclei $^{118,120}Sb$ in order to make spin-parity assignments to low-lying states in the residual nuclei. Relative differential cross sections were measured by using the time-of-flight technique in conjunction with a pulsed proton beam from a 5.5-MeV Van de Graff accelerator. Signals produced by protons incident on a liquid scintillator were processed by instrumentation which discriminated against gamma rays and also reduced the effect of electronic "walk." The system had a resolution of 15 keV at a neutron energy of 2 MeV. Absolute total (p,n) cross sections were measured to an accuracy of ±5% by using BF_3 counters to detect neutrons which had diffused through a graphite moderator. Angular distributions and 30° and 90° excitation functions were measured for the $^{117}Sn(p,n)^{117}Sb$ reaction. Author (NSA)

N69-17311# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
MAGNETIC MOMENT MEASUREMENTS FOR SHORT LIVED NUCLEAR STATES
A. Z. Khrynkevich 1968 35 p refs Lecture presented at Helsinki
(JINR-E3-4062) CFSTI

A general review of methods used for measuring magnetic moments of short-lived nuclear states is given. Principles, possibilities, and limitations of methods based on the Moessbauer effect and on the angular correlation of nuclear radiations are presented in more detail; and some recent methodical refinements are described. Author (NSA)

N69-17318 NOLIT Publishing House, Belgrade (Yugoslavia)
THE BEHAVIOR OF I-131 IN POLYMETATELLURIC ACID IRRADIATED IN THE NUCLEAR REACTOR
Cedomir Teofilovski *In its* Bull. of The Boris Kidric Inst. of Nucl. Sci., Vol. 17, No. 1 1966 p 17-27 (See N69-17315 07-34) refs
Avail: CFSTI

Polymetatelluric acid, whose composition is $(H_2TeO_4)_n$, is successfully used at the Institute as a target for obtaining ^{131}I in the reactor. It is prepared by heating orthotelluric acid in air at 160°C or in a stream of water vapor at 208°C. Analysis of the valency states of ^{131}I in irradiated $(H_2TeO_4)_n$ prepared in either of the above ways shows a variable ratio of reduced and oxidized forms. A considerable increase of the reduced forms with increasing integral thermal neutron flux during irradiation in the reactor in the given interval has also been observed. In order to explain the above phenomenon $(H_2TeO_4)_n$ was irradiated in the reactor under different conditions, with measurement of the wall temperature of the quartz ampoules containing the target material. Yields of reduced and oxidized forms of ^{131}I were determined immediately after irradiation and after annealing of the target at temperatures from 60° to 150°C. A considerable decrease in the yield of the reduced forms of ^{131}I on target annealing above 100°C was observed. Author

N69-17340 Princeton Univ., N. J.
SUPER PERTURBATION THEORY AND BOUNDS ON ELECTRON HYDROGEN SCATTERING
Rabinder Nath Madan (Ph.D. Thesis) 1967 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-8944

A formulation of super perturbation theory for scattering on two novel approaches for evaluating phase shifts is developed. An elegant mathematical formalism for the most general Schroedinger equation is explored. A theoretical error is determined by calculating upper and lower bound phase shifts by a rigorous treatment of e^--H s-wave scattering in the triplet state as a test of a certain kind of variational method. A maximum reducible error of 3 percent is reported. Dissert. Abstr.

N69-17341 Ohio State Univ., Columbus.
TECHNIQUES DEVELOPED FOR MEASURING DIRECTIONAL CORRELATIONS BETWEEN X-RAYS AND CONVERSION ELECTRONS OR GAMMA RAYS IN THE STUDY OF CERIUM 139
Paul Russell Messel (Ph.D. Thesis) 1967 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8857

The advent of the lithium drifted solid state detector has provided significant advantages over scintillation detectors for gamma ray and conversion electron spectroscopy. In order to use the solid state detectors for coincidence work, a method of generating a timing mark from the amplified linear detector output pulse was necessary. A coincidence system was developed using the new nuclear instrument modules so that a time mark was generated either from the leading edge of the unipolar or bipolar pulse, or from the zero crossing point of a bipolar pulse produced by doubly differentiating the amplified detector output. The system had a time resolution capability variable from about 5 nsec to 100 nsec. Coincidence measurements with x rays down to approximately 2 KeV was made possible by the application of a photomultiplier tube with a recently developed high efficiency photocathode. Dissert. Abstr.

N69-17342 California Univ., Berkeley.
A BEAM STUDY OF IONIC MOLECULAR NITROGEN PLUS HYDROGEN, HYDROGEN DEUTERIDE, DEUTERIUM REACTION DYNAMICS
William Ronald Gentry (Ph.D. Thesis) 1967 76 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-10328

An ion beam-collision cell method was used to measure the product energy and angular distributions from reactions of N_2^+ with H_2, HD and D_2 in the primary ion energy range 25-135 eV. The data include three contour maps each for the H_2 and D_2 experiments (taken at low, intermediate and high energies) showing the entire distribution of product intensity in the center of mass coordinate system. The distributions have a crater-like shape around the center-of-mass point. At large scattering angles the intensity varies slowly with angle, and the velocity at the rim of the crater is independent of angle in the center-of-mass system. All of the distributions have a peak at 0° scattering angle which shows little spreading in energy or angle over the spread in the primary ion beam. The intensity of this peak is 3-500 times that for the large angle scattering. Kinematic analysis of the distributions shows that all product ions are formed with high excitation energies. Dissert. Abstr.

N69-17343 Florida State Univ., Tallahassee.
THE ELASTIC SCATTERING OF ALPHA PARTICLES BY Ca 40 FROM 12 TO 18 MeV
Charles Paul Robinson (Ph.D. Thesis) 1967 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-7797

Sixty-four point angular distributions for the elastic scattering of alpha particles by ^{40}Ca have been measured from 12 to 18 MeV in 100 keV intervals. The angular range was from 26.7° to 176.1° (c.m.). Optical model fits to these data were obtained using a Woods-Saxon real potential and a surface imaginary potential with a form given by the derivative of a Woods-Saxon function. The radius of the real well was set to a value of 5.2 F, consistent with electron scattering results. A representative set of angular distributions covering the entire range was fitted to establish a consistent set of the other geometric parameters. Two parameter fits to all the data were then obtained by varying only the real and imaginary potential strengths. A fitting criterion which compensates for the large Rutherford contribution to the scattering at forward angles was found to give much improved fits. Dissert. Abstr.

N69-17345# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
MODIFIED ELECTRON SPIN RESONANCE SPECTRUM SIMULATION PROGRAM
A. Inzaghi and L. Mongini 1968 41 p refs
(EUR-4064.e) Avail: CFSTI

The report describes an IBM 360/65 modified version of the Electron Spin Resonance Spectrum Simulation Program for computer simulation. Author

N69-17346 Michigan Univ., Ann Arbor.
A MEASUREMENT OF THE SPIN-EXCHANGE CROSS SECTION OF Cs 133, Rb 87, Rb 85, K 39 AND Na 23
Neil William Ressler (Ph.D. Thesis) 1967 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-7703

This thesis reports measurements to determine the spin-exchange cross section for collisions between like alkali atoms. The spin-exchange cross section was determined for Cs^{133}, Rb^{87}, Rb^{85}, K^{39}, and Na^{23}. The lifetime of the alkali atoms in the Zeeman sublevels of the ground state hyperfine levels is dominated by spin-exchange collisions. The spin-exchange collision rate is therefore reflected by the linewidth of the microwave absorption spectrum observed in the magnetic dipole transitions between various of the Zeeman sub-levels. The measurements employed an X-band electron paramagnetic resonance spectrometer. The alkali metal was distilled into a sample bulb which was placed inside a dewar in a resonant cavity. The bulb was then heated to a temperature corresponding to an equilibrium vapor density of approximately 10^{15} alkali atoms/cc. and the microwave absorption spectrum was recorded. Dissert. Abstr.

N69-17353# Reactor Group, United Kingdom Atomic Energy Authority, Sellafield (England).
THE BEHAVIOUR OF FISSION GASES IN IRRADIATED URANIUM DIOXIDE: A RE-SOLUTION PROCESS
A. J. Manley 5 Jul. 1968 27 p
(TRG-1681) Avail: CFSTI: UK 4s 6d

The re-solution of gas atoms from bubbles into the irradiated UO_2 matrix is considered as a particle collision process. A semiempirical approach is made to the problem of the rate of knockout. On this basis bubble diameters within grains would not be larger than 40 Å after irradiation times of $\approx 10^8$ sec and ratings of 20 MW/te, which is in agreement with observation. The mean time for which fission gases are trapped in bubbles is independent of the bubble size and for a rating of 20 MW/te is ≈30 days. The application of the model to intergranular gas bubbles requires a knowledge of the grain boundary diffusion coefficient. This can be obtained by fitting the model to experimental data for the time-temperature dependence of the onset of optically detectable intergranular porosity. It is then possible to predict the conditions of time and temperature at which the grain-boundary bubbles will touch. For irradiation times of $\approx 10^8$ sec they should do so at ≈1150°C. Re-solution will tend to amplify the effect of stress on bubbles by further increasing their radii if the applied stress is tensile, or further decreasing them if compressive. Grain boundary bubbles greater than 0.7 μ dia will be unstable under any tensile stress. Author (NSA)

N69-17356# Iowa State Univ. of Science and Technology, Ames.
DEFORMED POTENTIAL MANY-PARTICLE THEORY
Jerry Paul Draayer (Ph.D. Thesis) Aug. 1968 157 p refs
(Contract W-7405-eng-82)
(IS-T-269) Avail: CFSTI

The relation between the U(3) ⊃ R(3) state labeling scheme introduced by Elliott for a description of many particles moving in an isotropic harmonic oscillator potential and the Gel'fand U(3) ⊃ U(2) × U(1) state labeling scheme introduced by Nagel and Moshinsky is established. A rule complementary to the one given by Elliott for the quantum number K required in the U(3) ⊃ R(3) reduction is given and the use of K in state labeling is clarified. An explicit expression for the transformation brackets between the two state labeling schemes is obtained and the results used to derive an explicit expression for both the U(3) ⊃ R(3) coupling coefficients and projected tensor matrix elements. Application of the invariance of the commutators of the infinitesimal generators of U(3) to a canonical transformation is used to generalize these results to a deformed potential many-particle theory. Author (NSA)

N69-17358# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
PROBLEMS IN VECTOR MESON THEORIES
Wolfhart Zimmermann Aug. 1968 22 p refs
(DESY-68-47) Avail: CFSTI

A number of difficulties which occur in any Lagrangian field theory involving vector mesons are discussed. Unfortunately it has not yet been possible to resolve these problems for Yang-Mills fields or charged vector mesons in general. Therefore the study is restricted to the case of neutral vector mesons in which case one can give a fairly complete analysis of the problems. The model of a massive vector field coupled to a conserved current is considered, and models of two vector fields which are coupled to the same current are described. Author (NSA)

N69-17365# Gulf General Atomic, San Diego, Calif.
NEUTRON AND GAMMA RAY PRODUCTION CROSS SECTIONS FOR SILICON Final Report, Sep. 1967–Apr. 1968
M. K. Drake May 1968 209 p refs
(Contract DASA01-68-C-0036)
(AD-679907; GA-8628; DASA-2099) Avail: CFSTI CSCL 20/8

A survey was made of the available information on neutron and gamma ray production cross section measurements of silicon. Evaluated nuclear data sets were prepared for silicon that cover the energy range from 0.001 eV to 20.0 MeV. These cross section sets were based on experimental results available to January 1968 and on nuclear model calculations. Author (TAB)

N69-17366 Princeton Univ., N. J.
INTERNAL SYMMETRIES IN S-MATRIX THEORY
Darryl Douglas Coon (Ph.D. Thesis) 1967 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-8914

A rigorous abstract treatment of internal symmetry in S-matrix theory is reviewed, developed and applied to particular cases. It is shown that all the consequences of internal symmetry, including kinematic identity of the channels involved, follow from a simple criterion by rigorous application of unitarity and crossing. Among the symmetries which are found in the scattering of the eight pseudoscalar mesons (π, K, η) with various conditions on the masses are isotopic spin, G_2, C_2, SU_2(quark) × SU_2(anti-quark) and SU_3. Some other solutions have not been identified with a symmetry group. Accepting SU_3 in the pseudoscalar-baryon system and postulating further symmetry, we find the Barger-Rubin and Johnson–Treiman relations among the solutions. Also, a definite, finite prediction for f/d is obtained. General formulas are derived for f/d and determinations of f/d are obtained from cross section data. A criticism of the usual approximate dynamical schemes which claim to derive internal symmetries is included. Dissert. Abstr.

N69-17367 Michigan Univ., Ann Arbor.
SOME ASPECTS OF THREE-PARTICLE SCATTERING
John Anthony DeSanto (Ph.D. Thesis) 1967 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-7581

This paper is concerned with aspects of three-particle scattering phenomena and the question of whether a resonance can itself serve as a resonance generating mechanism. Three particles, two pions and a nucleon, scattering through bound states of one pion and the nucleon are considered. There are two bound pion-nucleon states corresponding to the nucleon itself and the N^* (1236) resonance. This coupled channel problem using off-energy-shell techniques were investigated. The problem is solved by initially considering the N^* to be stable and then analytically continuing to the unstable particle parameters. The resulting analytic properties of the scattering amplitudes and the conditions under which a resonance can be generated are discussed. The connection of this work with Lee model calculations involving an unstable ν particle is noted. Dissert. Abstr.

N69-17370 Pennsylvania State Univ., University Park.
PRESSURE SHIFTS OF THE CESIUM GROUND STATE HYPERFINE INTERACTION DUE TO VARIOUS BUFFER GASES
Leslie Michael Kohuth (Ph.D. Thesis) 1967 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-8713

An optical double resonance detection method has been used to determine the change in the cesium ground state hyperfine interaction as a function of buffer gas pressure. The problem encountered involved the following objectives. It was necessary to construct an apparatus capable of measuring these pressure shifts which are of the order of 10 kHz out of 9 GHz. It was also necessary to find buffer gases which did not react with cesium. Buffer gases with permanent electric dipole moments were also sought in the hope that they would cause large pressure shifts in the hyperfine interaction. Dissert. Abstr.

N69-17372# Akademiya Nauk URSR, Kharkov. Institut Teoreticheskoi Fiziki
CHIRAL U(3) × U(3) AND SU (3) × SU (3) DYNAMICS
V. I. Sabo 1968 24 p refs In RUSSIAN; ENGLISH summary
(ITF-68-63) Avail: CFSTI

A number of consequences which can be tested experimentally from the chiral U(3) × U(3) and SU(3) × SU(3) dynamics introduced earlier is obtained. The principle of the "minimum broken symmetries" is formulated and physically grounded in the framework of the dynamics suggested. The experimental consequences from this principle agree with the available experimental data for the strong interactions at the low energies. The electromagnetic interaction is introduced, and it is shown that the predictions of the dynamics introduced agree with the experimental data for the low-energy photoproduction of the pseudoscalar mesons. The dynamics of weak interactions, without considering the break of the strong interaction symmetries, are constructed; they are in qualitative agreement with the available experimental data. Author (NSA)

N69-17383 Illinois Univ., Chicago.
REGGE POLE AND K-MATRIX MODELS FOR TWO PARTICLE REACTIONS
Gerald Eugene Hite (Ph.D. Thesis) 1967 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-8112

A generalized expression for Reggeized helicity amplitudes is presented. It is found that the kinematic t-singularities of the amplitudes associated with a Regge trajectory for a given reaction are described by a single function whose origin can be easily understood in terms of angular momentum coupling rules. A discussion is given concerning the constraints imposed on the Regge residue functions from the demand that certain physical quantities, such as the cross section, be free of kinematical singularities. Particular consideration is given to the t-channel reaction $\bar{N}N \rightarrow PV$. Solutions for the residue functions are obtained for this reaction for all trajectories with natural parity and for all trajectories with unnatural parity whose G-parity restricts the $\bar{N}N$ channel spin to be zero. Using these solutions, cross sections and decay correlations for the vector meson are calculated for comparison. The K^+p reactions near 1 BeV/c are studied using the K-matrix formalism. Dissert. Abstr.

N69-17385 Michigan State Univ., East Lansing.
REACTION MATRICES FOR FINITE NUCLEI
David V. Grillot (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-7895

A method for calculating the reaction matrix elements of a closed-shell nucleus is discussed. An improved treatment of the Pauli operator is proposed, and accurate solutions of the Bethe-Goldstone are obtained for the coupled and uncoupled integro-differential equations. The solutions are used to obtain the first order binding energy of ^{16}O using the Hamada–Johnston and Brueckner–Gammel–Thaler potentials. The results indicate that the Hamada–Johnston potential gives too little binding and possible ways of improving the binding energy calculations are discussed. The reaction matrix is examined as a function of the single particle energies. Dissert. Abstr.

N69-17421 Oregon Univ., Portland.
NONLOCAL MODEL T-MATRICES IN A QUASI-THREE-BODY REACTION
Philip Allen Deutchman (Ph.D. Thesis) 1967 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-9988

The (p,2p) cross section is calculated using local and non-local (p,p) effective interactions. The quasi-three body assumption is used in which the effects of other channels are taken into account with a complex potential. The formalism used is the distorted wave t-matrix approximation in the static limit. The distorted waves are approximated by fairly simple, but realistic optical wave functions. The parameters involved in these approximate optical waves are determined using a local t-matrix and a good fit to the more complicated DWTA theory is obtained. The effects of these parameters on the (p,2p) cross sections are indicated. Then three values for the nonlocal range parameter R are chosen, one of which is the local t-matrix and the parameters in all the t-matrices are adjusted so as to fit (p,p) scattering as closely as possible. The theoretical calculations fit the experimental (p,p) energy distribution at 90° in the center of mass system over a wide range of energies.
Dissert. Abstr.

N69-17431# Oklahoma Univ., Norman. Research Inst.
ELECTRONIC STRUCTURE OF ATOMS AND MOLECULES Final Report, 1 Jul. 1959-31 Aug. 1968
Chun C. Lin Nov. 1968 15 p refs
(Contract Nonr-982(07))
(AD-679745; OURI-1226) Avail: CFSTI CSCL 7/4

The results of a program of research on the energy levels and electronic structure of atoms and molecules are described. Specific topics of research include (1) electronic structures, correlation effects, and configuration interactions of free atoms, (2) properties of rotational energy levels of molecules including Zeeman effect, (3) magnetic susceptibilities and energy levels of transition element and rare earth element ions in crystals, (4) electron energy band structures of simple crystals by the tight-binding method, (5) determination of the position of the atomic impurity energy levels with respect to the valence band of the host crystals.
Author (TAB)

N69-17440 Washington Univ., Seattle.
THREE-PARTICLE CORRELATIONS IN NUCLEAR MATTER
Edmund Oliver Fiset (Ph.D. Thesis) 1967 200 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-9282

A calculation of the effects of three particle correlations in nuclear matter is made. The approach used is the Martin-Schwinger-Puff Green's function formalism of quantum statistical mechanics. The heirarchy of Green's function equations is terminated by factoring the four particle Green's function to yield an integral equation for the three-particle Green's function. A three particle T-matrix is defined and is found to obey an integral equation of the Fadeev form. Consequently heavy reliance is placed on earlier two particle theories. The energy and density are calculated in terms of the T-matrix. Careful studies of the analytic properties of T and of the two body t-matrix simplify the energy and density equations considerably so that both are found to consist of the old two particle result plus an additive three particle correction. The change is such that only the momentum distribution of the particles is altered by the three particle correlations. The single particle energy spectrum is unchanged from the two particle result.
Dissert. Abstr.

N69-17444 Princeton Univ., N. J.
ELECTROMAGNETIC SELF-ENERGIES
Paul Martin Fishbane (Ph.D. Thesis) 1968 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-9677

Self-energies are expressed in terms of various scattering quantities which may result from the electromagnetic-magnetic interaction. The Lee Model was discussed in order to give the V particle mass shift as an integral over N-θ scattering phase shifts. Dispersion theory was applied to express this self-energy as another sum over phase shifts. An expanded exactly soluble Lee model with inelasticity is examined to express the V self-energy as an integral over a sum of scattering eigenphaseshifts. The electron self-energy in quantum electrodynamics is expressed via sidewise dispersion relations as a sum over certain multipoles of Compton scattering. It is shown that this approach very readily gives the correct result in the perturbation theory limit. Sidewise dispersion relations are used to examine the neutron-proton mass difference to order e^2.
Dissert. Abstr.

N69-17445 Saskatchewan Univ., Saskatoon.
THE INTERACTION OF HIGH ENERGY ELECTRONS WITH LITHIUM-6 AND LITHIUM-7
Ronald Malcolm Hutcheon (Ph.D. Thesis) 1968 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-9726

The 140 MeV electron linear accelerator was used to measure the electron scattering and electrodisintegration cross sections of lithium 6 and lithium 7. The inelastic electron scattering form factors were measured for the low lying excited states of both isotopes, and in some cases there are large discrepancies between the present and previous results. Most of these were traced to the presence of a very large quasi-continuous cross section underlying the narrow levels of both Li^6 and Li^7. Because of the improved resolution, the narrow peaks were resolved from the continuous background whereas, previously, a large portion of the continuous cross section was included in the area of the peaks. The theoretical fits to the Li^6 elastic and inelastic form factors indicate that the data cannot be fitted using a simple harmonic oscillator model with the same oscillator parameter for the s- and p-shells. However consistent results are obtained using an s-shell parameter of approximately 1.63 fm and a p-shell parameter of approximately 2.0 fm.
Dissert. Abstr.

N69-17457# Michigan Univ., Ann Arbor. Dept. of Physics.
ON THE WIGNER SUPERMULTIPLET SCHEME
K. T. Hecht and Sing-Chin Pang Sep. 1968 106 p refs
(Contract Nonr-1224(59))
(AD-679762; REPT-07591-3) Avail: CFSTI CSCL 20/8

Calculation of Wigner and Racah coefficients for the group SU(4) contains (SU(2) x SU(2)) make it possible to perform the spin, isospin sums in the cfp expansion of the matrix elements of one- and two-body operators in the Wigner supermultiplet scheme. The SU(4) coefficients needed to evaluate one- and two-particle cfps, the matrix elements of one-body operators, and the diagonal matrix elements of two-body operators are calculated in general algebraic form for some many-particle states. Applications are made to the calculation of the matrix elements of the complete space scalar part of the Coulomb interaction and the space scalar part of the particle-hole interaction for nucleons in different major oscillator shells.
Author (TAB)

N69-17458# Michigan Univ., Ann Arbor. Dept. of Physics.
FIVE DIMENSIONAL QUASISPIN CLASSIFICATION OF SHELL MODEL STATES IN THE SENIORITY SCHEME
Richard P. Hemenger Sep. 1968 105 p refs
(Contract Nonr-1224(59))
(AD-679763; REPT-07591-3-T) Avail: CFSTI CSCL 20/8

States of configurations j(superscript N) of the nuclear shell model are classified using the properties of a five dimensional

rotation group. A basis is used in which states of a given irreducible representation (specified by seniority and reduced isospin) are labeled with the physical quantum numbers N (nucleon number) and T, M sub T (isospin quantum numbers). A fourth quantum number is needed for a complete classification. Although there appears to be no fourth commuting operator which is either simple or of clear physical relevance, for all problems of practical importance this fourth number takes no more than two distinct values for fixed N,T and M sub T. It is shown how a complete classification can be made for these cases with results which are tractable and symmetrical under particle-hole conjugation. For the special case of seniority 2 and reduced isospin 1 the complete N,T dependence of matrix elements of the most general two-body interaction is found for an arbitrary j-shell or mixed configuration. This is carried out using a generalized Wigner-Eckart theorem. Author (TAB)

N69-17464# Hamburg Univ. (West Germany). Institut fuer Theoretische Physik (2).
INCLUSION OF THE HIGHER-SPIN ISOBARS IN N-N INTERACTION AND THE COMPLETE STRONG-COUPLINGS S-WAVE SOLUTIONS WITH A HARD CORE
Siegfried Wagner Sep. 1968 19 p refs
(DESV-68/49) Avail: CFSTI

The strong coupling potentials derived by Fierz contain the transitions between an infinite set of isobaric two-nucleon states. Except for the non-excited nucleon states, the channels with one or two nucleons in the state N_{33} give an important contribution to the phase shifts; this has been shown previously. The contribution of the higher-spin states is discussed here; only some spin-5/2 isobaric states have an appreciable effect, and all higher isobars may be neglected. The complete strong coupling S-wave solutions are discussed in some detail in comparison with the newest experimental phase shift analysis. The influence of charge-symmetry breaking due to the difference in the neutral and charged pion mass is studied for the S-waves. Author (NSA)

N69-17465# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
MATRIX ELEMENTS OF THE UNITARY REPRESENTATIONS OF THE HOMOGENEOUS LORENTZ GROUP
H. Joos and R. Schrader Aug. 1968 17 p refs
(DESY-68/40) Avail: CFSTI

In the representation space of the Main Series of SL(2,C) there exists an improper basis, in which the representation of a Cartan Subgroup is diagonal. The matrix elements with respect to this basis can be obtained with the help of differential equations. In this form the connection between the unitary representations and the spinor representations becomes more transparent. Author (NSA)

N69-17498# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
RANGE-ENERGY DATA FOR KeV IONS IN AMORPHOUS MATERIALS. COMPUTED FROM THE THEORETICAL ANALYSIS OF LINDHARD, SCHARFF, AND SCHIOTT (1963)
K. B. Winterbon Nov. 1968 39 p refs
(AECL-3194) Avail: Available from Atomic Energy of Canada, Ltd., Chalk River: $1.00

A program has been written to compute the parameters used in the analysis of stopping, viz. effective atomic number, Z, screening length, a, dimensionless energy, ϵ, and dimensionless range, ρ, for energy of 1 keV and range 1 $\mu gm/cm^2$ respectively, and the electronic stopping parameter, k. A table of values of these for some projectiles and targets is given. Another program calculates path length, $\rho_k(z)$, given k and ϵ. A table of path lengths for some values of k and ϵ is given. Author

N69-17505# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
A CALCULATION OF THE NEUTRON SCATTERING BY LIQUIDS AS MEASURED WITH THE COLD NEUTRON TIME-OF-FLIGHT TECHNIQUE
R. A. Cowley Sep 1968 15 p refs
(AECL-3189) Avail: Available from Atomic Energy of Canada, Ltd., Chalk River: $0.50

Calculations are made of the neutron scattering from a liquid. The model for the liquid is to assume the scattering function, $S(Q,\omega)$, is for each wavevector Q, a Gaussian function of frequency, ω, centered around $\omega=0$, with a height and width chosen so that $S(Q,\omega)$ is consistent with the measured structure factor, S(Q), and the known second moment of a classical liquid. The results for the calculation of the neutron scattering obtained with the cold neutron time-of-flight technique give peaks at finite energy transfers. When the locations of these peaks are plotted as a dispersion curve in (ω,Q) space the results are in agreement with those reported from experiments on liquids. It is concluded that the earlier interpretation of these peaks in terms of phonon-like excitations in liquids may not be correct. Author

N69-17508# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Research.
MECHANISM OF THE Pu-239 FISSION BY MUONS
A. Butse, N. Grama, M. Petrashku, V. Khukubei, D. Dorchoman et al 1968 12 p In RUSSIAN; ENGLISH summary
(JINR-P1-4051) Avail: CFSTI

The probability ratio of the nonradiative and ordinary fission in μ-mesic atoms of ^{239}Pu nuclei was measured with a gas scintillation counter and using two-dimensional analysis. It is supposed that the probability of the nonradiative fission mechanism is connected with the measurement effect of the fission barrier under the influence of the μ-mesons, which was predicted by Zaretsky et al. Author (NSA)

N69-17514 Michigan Univ., Ann Arbor.
LAMBDA-PROTON INTERACTIONS
Walter Leonard Gibbs (Ph.D. Thesis) 1967 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-7606

The lambda-proton interaction was studied having a center of mass energy ranging between 2050 Mev and 3500 Mev, with particular attention being paid to the possibility of resonance phenomena. The experiment is part of a study of the interactions of 3.65 Bev/c π^+ mesons in a deuterium filled bubble chamber. The lambdas were created in reactions of the type $\pi^+ d \rightarrow p\Lambda(K\pi)^+$, where $(K\pi)^+$ is a combination of pions and kaons which have net positive charge, isospin 1/2 or 3/2, and strangeness +1. Departures in the behavior of protons and lambdas from the behavior predicted by assuming no interaction are carefully examined. The behavior of the proton is examined in light of the spectator model, based on the impulse approximation and the Hulthen theory of the deuteron. The behavior of the lambda is examined in light of properties of the reaction $\pi^- p \rightarrow \Lambda(K\pi)^0$, where $(K\pi)^0$ is a combination of pions and kaons having strangeness +1, isospin 1/2 or 3/2, and zero net charge. This reaction is charge symmetric to the reaction $\pi^+ N \rightarrow \Lambda(K\pi)^+$ and, assuming charge symmetry, the cross sections are equal. Dissert. Abstr.

N69-17515 Michigan Univ., Ann Arbor.
A HIGH RESOLUTION GAMMA-RAY SPECTROSCOPIC STUDY OF THE DECAYS $Ba^{133} \rightarrow Cs^{133}$ and $Ge^{77} \rightarrow As^{77}$
Denis Philip Donnelly (Ph.D. Thesis) 1967 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-7584

A study was made of gamma radiation following the decays of ^{133}Ba and ^{77}Ge. All the measurements were made using Ge(Li) spectrometers, with the exception of a few energy measurements which were made using a 2m curved crystal spectrometer. In ^{133}Ba, energy and relative intensity measurments were made on seven gamma rays; gamma-gamma coincidence measurements were made gating on the 383.9, 356.0, 302.9, 276.4, 81.0, 79.6, and 53.1 keV gamma rays. The measurements quantitatively support the existing decay scheme. K conversion coefficients were calculated by using the present gamma-ray relative intensities and published K internal conversion electron intensities. In ^{77}Ge, energy and relative intensity measurements were made on 81 gamma rays; seven of these energies were measured using a 2 m curved crystal spectrometer. A level scheme was constructed which includes 25 excited levels and 72 transitions. Dissert. Abstr.

N69-17518 Illinois Univ., Urbana.
MEASUREMENT OF THE TWO-PHOTON DECAY OF THE K_L MESON
John Andrew Todoroff (Ph.D. Thesis) 1967 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-8249

The decay $K^0_L \rightarrow 2\gamma$ was observed and the branching ratio was measured in a spark chamber counter experiment. A branching ratio was obtained roughly consistent with a model for $K^0_L \rightarrow 2\gamma$ in which the decay proceeds through virtual π^0 and η^0 states. However, the calculation with this model depends strongly on the unmeasured absolute rate of $\eta^0 \rightarrow 2\gamma$ and close comparison with this theory must await a good measurement of the η^0 lifetime. The measurement was performed on a beam of K^0_L's of a mean momentum of 1.0 BeV/c. The beam, 10.5 cm. wide × 15 cm. high, passed through a detection system that was sensitive to the decays over a length of about one meter. Decay photons from $3\pi^0, 2\pi^0$, and 2γ events converted and initiated showers in lead plates within two symmetrically placed spark chambers. Shower energies were measured with an average resolution of ±30% with lead and scintillator total absorption counters behind each spark chamber. Dissert. Abstr.

N69-17522 Colorado Univ., Boulder.
RELATIVISTIC INTERACTION BETWEEN A ROTATING ELECTRON BEAM AND A MICROWAVE FIELD INSIDE A WAVEGUIDE AT THE CYCLOTRON FREQUENCY
George James Sehn (Ph.D. Thesis) 1967 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-10602

In transverse-wave electron beam devices, rotating electrons interact with rf electric fields parallel to the plane of rotation. To produce net microwave field gain, the electrons must be sorted or bunched such that more electrons lose kinetic energy to the fields than gain energy. In addition to the electron bunching mechanism due to the transverse rf magnetic fields, it is shown that the relativistic shift in the electron cyclotron frequency is an equal or greater source of favorable electron bunching. As a quantitative example, the relativistic Lorentz equation and Maxwell's equations are solved simultaneously via a small-signal analysis to find the dispersion relation for a cylindrical TE_{11} (or rectangular TE_{10}) microwave field propagating in the presence of a low-velocity, thin, hollow, rotating electron beam. Interaction occurs near the electron cyclotron frequency determined by a dc magnetic field parallel to the guide axis. Dissert. Abstr.

N69-17524 New York Univ., N. Y.
CONTRIBUTIONS TO THE THEORY OF DISCONTINUOUS GROUPS OF MOEBIUS TRANSFORMATIONS
Charles Ivars Kalme (Ph.D. Thesis) 1967 51 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-10071

The dissertation consists of two parts, related in that they both deal with discontinuous groups of Möbius transformations. Part I contains a complete classification of the possible connectivities of components of Kleinian groups, correcting an erroneous statement appearing in the literature, which says that the connectivity of a component of a Kleinian group need always be 1,2, or ∞. Part II contains a discussion of two examples of one-dimensional Teichmüller space of the annulus, is analyzed completely, and includes a discussion of the boundary of Teichmüller space. A complete description of the deformations of the base surface leading to the boundary of Teichmüller space is given, and it is shown how the boundary points reflect the limiting cases of these deformations. Dissert. Abstr.

N69-17525 Rochester Univ., N. Y.
CROSS SECTION MEASUREMENTS OF PION DOUBLE CHARGE EXCHANGE ON VANADIUM AT 31 MeV AND LITHIUM AT 30 MeV
Charles James Cook (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-9364

The differential cross section for the pion double charge exchange reaction on $V^{51}(\pi^+, \pi^-)$ at 31 MeV, production angle of 29°, and pion energy loss from 7 to 19 MeV, has been measured. Two events were observed. It is predicted that the pion would lose 13.3 MeV if the nucleus were left in its isobaric analogue state with $\Delta T_z = 2$. Thus this measurement is at least an upper limit on the cross section to the analogue state. Positive pions were produced within the Rochester 130 inch Cyclotron. Particle trajectories were recorded with foil spark chambers. The charge and moments of outgoing particles were determined with a truncated wedge magnet which contained a spark chamber in the center of its gap. Range of these particles was measured and compatibility of range and momentum was required for a good event. The detection system was tested with a negative pion beam. Dissert. Abstr.

N69-17535# Akademiya Nauk Ursr, Kharkov. Fiziko-Tekhnicheskii Institut.
AUTOMATION OF A NUCLEAR EXPERIMENT ON THE 4-MeV ELECTROSTATIC ACCELERATOR OF THE FTI OF THE ACADEMY OF SCIENCES, USSR. PART 1
V. A. Yamnitskii, A. F. Makarov, E. G. Kopanets, Yu. S. Korda, S. P. Tsytko et al 1967 97 p refs In RUSSIAN.
(NP-17611) Avail: CFSTI

An automated data acquisition and analysis system for experiments on (p,γ) and (p,p'γ) reactions is described. NSA

N69-17536# Los Alamos Scientific Lab., N. Mex.
ALPHA-ALPHA ELASTIC SCATTERING: A BIBLIOGRAPHY
Jean Furnish, comp. 16 Oct. 1968 23 p refs
(Contract W-7405-ENG-36)
(LA-4011-MS) Avail: CFSTI

Nuclear Science Abstracts was searched from volume 7 (1953) through volume 22 number 15 (Aug. 15, 1968) for material on the elastic scattering of alpha particles on alpha particles. The references are arranged numerically within each volume with the abstracts from the most recent volume presented first. Author (NSA)

N69-17556# Tufts Univ., Medford, Mass. Dept. of Physics.
HIGH ENERGY PHYSICS AT TUFTS UNIVERSITY Annual Progress Report

Julian K. Knipp Oct. 1968 47 p refs
(NYO-1984-12) Avail: CFSTI

The present status of the research and development program at Tufts University is described including nuclear emulsions, bubble chambers, nuclear physics, high energy photons (including lasers and proton polarization in neutral pion photoproduction), and theoretical research. A list of publications is also presented. NSA

N69-17559# Minnesota Univ., Minneapolis. School of Physics.
TRAPPING LIFETIME OF NEGATIVE IONS IN ROTATING SUPERFLUID HELIUM
W. P. Pratt, Jr. and W. Zimmermann, Jr. Aug. 1968 4 p refs
(Contract AT(11-1)-1569)
(COO-1569-33; CONF-680808-7) Avail: CFSTI

Measurements were made of the lifetime for the escape of negative ions trapped in rotating helium 2 as a function of temperature and pressure. These measurements concern lifetimes in the range from 10 to 1000 sec and were made between the temperatures of 1.09 and 1.88°K from the vaporization pressure to the solidification pressure. The results were analyzed in terms of the theoretical treatment of trapping based on the bubble model of the negative ion and the vortex-line model of the rotating liquid. NSA

N69-17561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROBLEMS CONCERNING RADIATION IN AN UNLIMITED MEDIUM WITH EVENLY DISTRIBUTED ISOTROPIC SOURCES
V. V. Pavlov 30 May 1968 14 p refs Transl. into ENGLISH from Inzh.-Fiz. Inst. Vopr. Dozimetr. Zashchit. Ot Izluch. (Moscow), no. 3, 1964 p 82-88
(AD-679538; FTD-MT-24-82-68)Avail: CFSTI CSCL 18/8

The article deals with problems of finding the amount of absorbed energy of nonscattered radiation in the total absorbed energy of radiation, and also with the error which develops during calculation of absorbed energy of radiation by using the build-up factor of a point isotropic source in an unlimited medium in the form of the total of the two exponents. Simpler and more accurate formulas are given for determination of dose and energy flow in an unlimited aqueous medium with sources. TAB

N69-17578# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
SU_3 CLEBSCH-GORDAN COEFFICIENTS IN THE 2s-1d SHELL NUCLEI
T. Sebe Sep. 1968 32 p refs
(AECL-3182) Avail: Atomic Energy of Can., Ltd., Chalk River: $1.00

In a recent article the author derived a general expression for the SU_3 Clebsch-Gordan coefficients based on the group chain $SU_3 \rightarrow R_3$. The present paper provides an Apex program for its numerical calculation. The basis states used here have been 1895 orthogonalized and are closely related to the non-orthogonal states of Elliott. The formula giving normalization coefficients has been improved in order to obtain these coefficients for any SU_3 representations without referring to their symmetry properties between $(\lambda\mu)$ and $(\mu\lambda)$. Explanations concerning many Apex subroutines, useful in writing shell-model programs, are also given. Author

N69-17612 Florida State Univ., Tallahassee.
THE SEQUENTIAL DECAY SIGMA(1660) YIELDS SIGMA(1385) pi YIELDS LAMBDA pi pi AND A SPIN AND PARITY DETERMINATION OF THE SIGMA(1660)
William Hildreth Sims (Ph.D. Thesis) 1967 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-7800

The reactions $K^-N \rightarrow \Lambda\pi^-\pi^0$ and $K^-P \rightarrow \Lambda^+\pi^+\pi^-$ are examined in the center of mass energy interval 1610-1720 MeV. Both reactions are found to be dominated by the two-body $\Sigma(1385)\pi$ intermediate state, with production from the I=0 initial state being favored. The results of a partial wave analysis indicate that the $\Sigma(1660)$ is produced in a formation reaction that decays with a spin and parity of $3/2^-$ Dissert. Abstr.

N69-17628# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
NONLOCAL QUANTUM THEORY OF SCALAR FIELD. 2: NONLOCAL INTERACTIONS
G. V. Efimov 1968 59 p refs In RUSSIAN; ENGLISH summary Presented at the Seminar in Inst. for Theoret. Physics, Kiev
(ITF-68-54) Avail: CFSTI

The axioms of nonlocal quantum field theory are formulated and a few variants of introducing the nonlocality into the theory of S-matrix are suggested. It is proved that the S-matrix of nonlocal theory is unitary in any order of perturbation theory and free from the ultraviolet divergences. Author (NSA)

N69-17630# Kansas State Univ., Manhattan. Dept. of Physics.
TANDEM VAN de GRAAFF PRE-OPERATIONAL RESEARCH Interim Progress Report, 1 Jan.-1 Oct. 1968
R. B. Leachman Oct. 1968 17 p refs
(Contract AT(11-1)-1766)
(COO-1766-10) Avail: CFSTI

Research at Kansas State University is briefly discussed. Isomer fission and particle capture gamma ray studies including gamma rays from neutron capture, Doppler shift, (p,γ) reactions on analog resonances in f-p shell nuclei, and (p,γ) reaction on T = 3/2 analog resonances in sodium-21 are described. Also discussed are inelastic proton scattering from odd-A nuclei, atomic channeling, charge-changing cross sections and ionization, and alignment development with lasers. Publications, reports, and talks are listed. NSA

N69-17631# Chicago Univ., Ill. Dept. of Physics.
MODELS FOR K AND η DECAYS
David Greenberg (Ph.D. Thesis) Jul. 1968 40 p refs
(Contract AT(11-1)-264)
(EFI-68-60; COO-264-444) Avail: CFSTI

Simple meson pole models for nonleptonic K decays and η decays are presented in the context of current-current Lagrangians for the weak and electromagnetic interactions. Consistency with low energy theorems of current algebra is demonstrated and comparison made with experiment. It is shown that violations of the $\Delta I = 1/2$ rule may be attributed to $\eta\text{-}\pi$ mixing. Author (NSA)

N69-17634 Princeton Univ., N. J.
AN EXPERIMENTAL STUDY OF NEGATIVE PION NUCLEUS SCATTERING FROM 0.8 TO 1.6 BeV
Edward Standish Miller (Ph.D. Thesis) 1967 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-8950

Measurements by counter techniques of the diffraction and absorption cross sections for the scattering of π^- mesons from nuclei are described. Results are given for twelve nuclei, Be, C, O, N, F, Na, Mg, Al, Cu, Zn, Ag, and Au, at six π^- kinetic energies from 800 to 1600 Mev, at twenty four angles in the laboratory in the range 2° to 15°. On the basis of optical model fits to the measured cross sections total absorption and elastic cross section are evaluated. The optical model calculation is performed by numerically integrating the wave equation for as many partial waves as are necessary. Using nuclear size parameters which have been determined from electron scattering experiments, fits are made to the real and imaginary parts of the optical potential. Dissert. Abstr.

N69-17647# Naval Radiological Defense Lab., San Francisco, Calif.
RECALCULATION OF NEUTRON OPTICAL MODEL PARAMETERS AND INELASTIC SCATTERING CROSS SECTIONS FOR Na, Mg, Al, Si, S, Ti, Cr, AND Fe
James M. Ferguson 21 Oct. 1968 18 p refs
(AD-679574; USNRDL-TR-68-116) Avail: CFSTI CSCL 20/8

A revised set of calculations of secondary gamma-ray production cross sections is presented. The new calculations differ from earlier ones in that they were performed with optical model potentials which were individually fit to elastic scattering data for the appropriate element. Optical model parameters for Na, Mg, Al, Si, S, Ti, Cr, and Fe are presented. Secondary gamma-ray cross sections for Na, Mg, and Al are compared with experiment. The use of individually fit values of the optical model parameters did not clear up all the discrepancies between the measurements and the calculations. Some possible reasons for the remaining discrepancies are suggested. Author (TAB)

N69-17653# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE COUPLING BETWEEN SHELL-MODEL EXCITATIONS AND CLUSTER EXCITATIONS IN LIGHT NUCLEI
V. V. Balashov and I. Rotter 16 Feb. 1968 14 p refs Transl. into ENGLISH from the Russian Report
(AD-679814; FTD-HT-23-1223-67) Avail: CFSTI CSCL 20/8

The reduced alpha-widths for some levels of 12C and 8Be are calculated in the framework of the shell model with intermediate coupling. A classification of alpha-transitions with regard to the permutation symmetry of the wave function is given. A comparison of calculated and experimental alpha-widths shows that for 12C the shell model gives values in the right order of magnitude only for those levels where no mixing with cluster levels takes place (levels 1 +). The mixing of shell model levels with levels of a collective nature is discussed. TAB

N69-17656# Oak Ridge National Lab., Tenn.
ON THE OPTIMIZATION OF SMALL-ANGLE SCATTERING EXPERIMENTS WITH SLIT GEOMETRY
F. Hossfeld and G. Maier [1968] 12 p refs Transl. into ENGLISH from Z. Angew. Phys. (W. Berlin), v. 22, 1967 p 145–149
(ORNL-TR-1983) Avail: CFSTI

In small-angle scattering experiments with slit-height geometry one measures an intensity distribution due to a scattering function distorted by a correctable slit-breadth effect and the effect of slit height. The influence of a finite range of measured intensity on retrievable information for two limiting types of scattering functions is discussed. The relationship of scattering function, slit-height function, and range of intensity distribution can be used for optimizing measurements and also in the design of apparatus. Author (NSA)

N69-17657 California Univ., Berkeley.
NUCLEAR DOUBLE RESONANCE DYNAMICS
David Alexander McArthur (Ph.D. Thesis) 1967 248 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-5777

The validity of the master equation with spin temperature assumption, as used to describe the nuclear double resonance detection of a rare spin species, is studied. The technique of nuclear double resonance following adiabatic demagnetization of F^{19} nuclei in the rotating frame (ADRF), has been used to study the resonance of .13% abundant Ca^{43} in CaF_2. Radio frequency (rf) pulses were applied near the Ca^{43} Larmor frequency after ADRF, and a study of cross-relaxation between F^{19} dipolar energy and Ca^{43} Zeeman energy in the rotating-frame effective field, measured the F^{19} dipolar spectrum in CaF_2 for this kind of transition. Audio saturation double resonance measurements of cross-relaxation rates yielded results in agreement with the pulsed experiments. Pulsed experiments showed no evidence of a finite F^{19} spin diffusion rate. Dissert. Abstr.

N69-17667# California Univ., Berkeley. Lawrence Radiation Lab.
CHARGE AND ENERGY DISTRIBUTION OF RECOIL ATOMS FROM THE ALPHA DECAY OF Th 226
Karlene Corbit Klages Gunter (Ph.D. Thesis) Sep. 1968 203 p refs
(Contract W-7405-ENG-48)
(UCRL-18313) Avail: CFSTI

The charge and energy distribution of ^{226}Th recoils from thin, electrostatically collected recoil sources were studied with a 180° double-focusing alpha spectrograph. It was determined that the energy distributions so obtained were the result of collisions between the recoils and atoms on or in the source plate. The charge distribution of the recoils associated with $^{226}Th\alpha_0$ peaked at a charge of +1 whereas those associated with the electron conversion process following the emission of a $^{226}Th\alpha_{111}$ peaked at a charge of +11. These charge distributions are likely not too different from those which would be obtained from the decay of gaseous ^{226}Th. In order to insure that the recoils sources used for the above study were thin, a series of experiments were carried out to determine the best method of preparing consistently thin alpha sources. Author (NSA)

N69-17684# Oak Ridge National Lab., Tenn.
TRANSMISSION AND RANGE OF FAST ELECTRONS IN THE ENERGY RANGE 4 TO 30 MeV
D. Harder and G. Poschet 1967 3 p refs Transl. into ENGLISH from Wuerzburg Univ. Phys. Letters 24B(10) (W. Ger.), 1967 p 519–521
(ORNL-TR-1862) Avail: CFSTI

Transmission coefficients and ranges of fast electrons in C, Al, Cu, Cd, and Pb were measured using a large-area proportional counter. The parameter governing the shape of the normalized transmission curve and the range-to-pathlength ratio was verified against predictions obtained with the diffusion theory. Author (NSA)

N69-17740# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sperpukhov (USSR). Inst. Fiziki Vysokikh Energii.
SCATTERING OF HIGH-ENERGY PARTICLES ON SMOOTH POTENTIALS
V. I. Savrin and O. A. Khrustalev 1968 13 p refs In RUSSIAN
(IFVE-STF-68-19-K) Avail: CFSTI

Scattering of high-energy particles on smooth potentials with nonconstant interaction radius has been considered. It is shown that the dependence of the cross-sections follows different laws for different angles. Author (NSA)

N69-17750*# Virginia Associated Research Center, Newport News.
KINEMATIC RELATIONS AND PHASE SPACE FOR THE REACTION M(x, xt)N
P. C. Gugelot Sep. 1968 36 p refs
(Contract NAS3-12178)
(NASA-CR-72467) Avail: CFSTI CSCL 20H

Relativistic invariant kinematic relations are used to analyze the interaction of an incoming particle with a particle bound in a nuclear system. The heuristic method presents the incoming nucleon x colliding with a nucleon t in the potential U with momentum and energy loss when imparting energy to unbound t and N after entering the nucleus. The motion of the nuclear frame S' is a direct result of the unbinding of t and N; S' thus provides the additional

equation which is required to satisfy energy and momentum. An example calculation describes the collison between the incident projectile and t in an ordinary two-body system. G.G.

N69-17752# United Kingdom Atomic Energy Authority, Harwell (England).
FURTHER CALCULATIONS OF NEUTRON SCATTERING CROSS SECTIONS OF POINT DEFECTS IN A RELAXED LATTICE
D. G. Martin Jul. 1968 16 p
(AERE-R-5841) Avail: CFSTI; UK 3s

Calculations of neutron scattering cross sections for a point defect, allowance being made for the relaxation of lattice atoms due to the defect, involve an infinite summation which cannot be evaluated conveniently. Two approximations have been considered: (a) only atoms which are relaxed by more than a certain value are included in the summation; (b) an improvement to approximation (a) is made by assuming that atoms not included in the summation comprise a continuum. Assuming approximation (b), expressions are derived for (1) the average differential cross section in a polycrystal, (2) the average total cross section in a polycrystal, and (3) the total cross section in a single crystal. For a cubic primitive lattice, scattering cross section curves of an interstitial were calculated for (1) and (2). The expression derived for (3), however, did not enable specific calculations to be made conveniently on a high-speed computer. Author (NSA)

N69-17753# Los Alamos Scientific Lab., N. Mex.
HIGH INTENSITY LITHIUM ION SOURCE
A. Septier and H. Leal [1968] 16 p refs Transl. into ENGLISH from Nucl. Instrum. Methods (Netherlands), no. 29, 1964 p 257-260
(LA-tr-68-45) Avail: CFSTI

A lithium ion source having an efficiency approaching 100% has been constructed in the form of a triode gun, using the thermionic emission properties of a lithium salt (β-eucryptite). The emitting surface is heated by electron bombardment. A current of 15 mA is obtained with an accelerating voltage of less than 10 kV. The low working temperature of the source (about 1200°C) thus prolongs the life of the emitter to several tens of hours. The beam leaving the source has a cross section of 4 × 1 cm^2 and a relatively small angle of divergence. Author (NSA)

N69-17760# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnio Energii.
PHASE TRANSITION IN HEAVY NUCLEI
V. G. Nosov 1967 24 p refs In RUSSIAN
(IAE-1465) Avail: CFSTI

Toward the end of the periodic table, the equilibrium surface of the nuclei becomes gradually less and less spherical. Rotational bands based on the ground state appear in the case of the ^{150}Sm to ^{152}Sm transition; a sudden increase of the moment of inertia appears also in the case of ^{152}Gd to ^{154}Gd. Between ^{190}Os and ^{192}Os the nucleus becomes less spherical; a similar behavior reappears between Rn and Ra. A theory was developed to explain the phenomena observed in the neighborhood of the phase transformation curve on the N-Z plane, correlating energies and N and Z values. The problem is illustrated by a specific example: the 2^+ level characterizing even-even nuclei has not yet been observed in the case of the doubly magic ^{208}Pb; but its neighbors, such as the $^{206,210-214}Pb$ isotopes, do possess 2^+ levels. No final solution of the problem is as yet available. NSA

N69-17789 Michigan Univ., Ann Arbor.
A SEARCH FOR STABLE FRACTIONALLY CHARGED PARTICLES
David M. Rank (Ph.D. Thesis) 1967 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-7701

A search for stable fractionally charged particles called quarks is described. Atoms formed with a +2/3 quark as a nucleus and an electron were sought with the aid of optical spectroscopy by an attempt to observe their Lyman series. Various substances were examined: sea water, lake water, seaweed, oysters, and plankton. With the aid of concentration techniques involving distillation in the presence of an electric field, limits were set on the concentration of quarks in these substances by our null result. For lake water and sea water, the concentration of + 2/3 quarks was $\leq 1 \times 10^{-18}$ quarks/nucleon; for the biological samples, the concentration of + 2/3 quarks was $\leq 1 \times 10^{-17}$ quarks/nucleon. A second series of experiments which attempted to detect fractional charges on oil drops also yielded a null result. Various oils were used: mineral oil, soya bean oil, peanut oil, and cod-liver oil. Our null result indicated that the concentration of quarks in these oils was $\leq 3 \times 10^{-20}$ quarks/nucleon. Dissert. Abstr.

N69-17794 Princeton Univ., N. J.
COMPARISON OF THE POSITIVE AND NEGATIVE KAON DECAY RATES INTO THE THREE PION AND MUON NEUTRINO MODES
William T. Ford (Ph.D. Thesis) 1967 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-8925

In an experiment at the Brookhaven AGS the decay rates of charged K mesons into the τ mode ($K^{\pm} \rightarrow \pi^{\pm}\pi^{\pm}\pi^{\mp}$) have been measured in order to test the equality of the τ^+ and τ^- rates. A difference between these rates would constitute a violation of CP invariance. At the same time the K^+ and K^- decay rates into the $K_{\mu 2}$ mode ($D^{\pm} \rightarrow \mu^{\pm}\nu_{\mu}$) were also compared, as a test of CPT invariance. The K mesons, identified with a Cerenkov counter, were allowed to decay in flight over a well-defined region at the end of which were detectors for the charged secondaries. To detect the τ decays an array of eight triangular scintillation counters arranged in an octagon was used, with the requirement that all three pions give a count. A second bank of counters placed behind an iron absorber detected the muons from $K_{\mu 2}$ decays. The result for the ratio of τ^+ and τ^- decay rates is $(\Gamma_{+}/\Gamma_{-})_{\tau} - 1 = -0.0004 \pm 0.0021$, consistent with CP invariance. Dissert. Abstr.

N69-17807# Los Alamos Scientific Lab., N. Mex.
ELIMINATION OF FLUTTER IN THE RADIO FLASH CODE
R. D. Richtmyer (Colo. Univ., Boulder) 28 Oct. 1968 8 p
(Contract W-7405-ENG-36)
(LA-4014-MS) Avail: CFSTI

Efforts to eliminate computation oscillations from the radio flash code EMP developed for the CDC-6600 computer led to investigation of an alternative difference system that is more dissipative in character. Several modifications of the new difference system were considered and a normal-mode analysis was made for each, with the result that the modification described in this report appeared to be relatively free of flutter and more stable than the original difference scheme. The modification has not yet been tested in the environment of full calculation. Author (NSA)

N69-17836# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
THE SCATTERING OF K AND Cs BY SEVERAL COMPOUNDS
E. F. Green (Brown Univ.), L. F. Hoffman (Brown Univ.), M. W. Lee (Brown Univ.), J. Ross (MIT), and C. E. Young (MIT) Nov. 1968 43 p refs
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-679743; MIT-45-PU) Avail: CFSTI CSCL 7/4

The nonreactive scattering of K from $C_{10}H_{16}$, $(CH_3)_3CBr$, $SiCl_4$, Cl_2, Br_2, I_2, ICl, $(CN)_2C=C(CN)_2$, and Cs from HBr has

been studied in experiments with crossed molecular beams. The primary alkali metal beam was velocity selected, and the scattered alkali metal was measured as a function of laboratory angle at a number of initial relative kinetic energies. Potential parameters are calculated from the rainbow scattering for K + C10H16, (CH3)3C Br, SiCl4, and Cs + HBr and also from the supernumerary rainbows for K + C10H16 and (CH3)3CBr. An optical model analysis on K+(CH3)3CBr and Cs + HBr yields information about threshold conditions for reaction, probability of reaction, and total reaction cross section as a function of relative energy. For system without rainbow scattering (K + halogens, (CN)2C = C(CN)2) an optical analysis made with a simple form for the absorption function requires a gradual change from a van der Waals potential at very large distances of separation of reactants to a more attractive potential at smaller distances. This indicates a gradual electron transfer on approach of reactants rather than on abrupt electron jump. Author (TAB)

N69-17844# Illinois Univ., Urbana. Dept. of Physics.
THE ZGS 7° NEUTRAL BEAM SURVEY
J. S. Frank, M. J. Glaubman, R. Thatcher, and A. Wattenberg Sep. 1968 14 p
(Contract AT(11-1)-1195)
(COO-1195-141; TR-173) Avail: CFSTI

The momentum distribution and intensity of K^0_L mesons and the background of neutrons were measured in the 7° neutral beam of the Argonne zero-gradient synchrotron. The momentum spectrum of the kaons was determined by observing regenerated K^0_S decays into $\pi^+\pi^-$ in a momentum analyzing spark chamber system. The integrated neutron background was determined by inserting thicknesses of Lucite into the beam and observing count rates. NSA

N69-17855# Los Alamos Scientific Lab., N. Mex.
ELECTRON SYNCHROTRON RADIATION: A BIBLIOGRAPHY
Jean Furnish, comp. 28 Oct. 1968 55 p refs
(Contract W-7405-ENG-36)
(LA-4018-MS) Avail: CFSTI

Nuclear Science Abstracts was searched from Volume 1 (1948) through Volume 22 Number 16 (August 31, 1968) for information on electron synchrotron radiation. The references include theory, laboratory experiments and astrophysical data. Each item has been roughly categorized for content as indicated by the following designations: (1) accelerator design and operation and calculations and experiments applicable to accelerator design; (2) astrophysics, solar physics, polarized cosmic radiations, space physics, van Allen belts and calculations and experimental work; (3) atomic physics and autoionization and photoabsorption; (4) experiments on the properties of synchrotron radiation; (5) miscellaneous; (6) plasma physics and calculations and experimental work; (7) reviews; (8) tabulated properties of synchrotron radiation technology of use as a source intensity standard; masers; (9) solid-state physics and photoabsorption, excitons, plasmons, and optical constants; and (10) theory. Author (NSA)

N69-17857# California Univ., Livermore. Lawrence Radiation Lab.
RADIATION EMISSION RATES FOR A NONRELATIVISTIC GAS WITH INDEPENDENT ELECTRONS
William H. Grasberger 1 Oct. 1968 15 p refs Sponsored by AEC
(UCRL-50496) Avail: CFSTI

The total radiation emission rate for a nonrelativistic gas with independent electrons for a nuclear charge Z, density ρ, and electron temperature T_e can be expressed by a formula identical to the bremsstrahlung emission rate formula, except that the free–free Gaunt factor is replaced by a generalized Gaunt factor. This generalized Gaunt factor is a function of the bound-state populations and the temperature. Results are given in graphical form of the generalized Gaunt factor for a plasma, where there are no bound-state populations, and for a gas in thermodynamic equilibrium. For the latter case, a scaling relation exists. The emission spectrum for a plasma is presented graphically for several values of the ratio of the ionization potential to the electron temperature. Author (NSA)

N69-17870 California Univ., Berkeley.
A COMPARATIVE STUDY OF (p, t) AND (p, He3) REACTIONS ON LIGHT NUCLEI
Donald George Fleming (Ph.D. Thesis) 1967 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-10320

The (p,t) and (p,^{3}He) reactions on ^{15}N and ^{13}C targets have been investigated. Transitions to mirror final states in the mass 13 and mass 11 final nuclei were studied over 15 and 12.5 MeV of excitation, respectively. Several new spin and parity assignments are made. In particular, the lowest 1p shell $T_<=3/2$ states in these nuclei have been identified. The DWBA predictions of the angular distributions arising from these (p,t) and (p,^{3}He) transitions were generally found to well reproduce experiment. For the ^{15}N(p,t)^{13}N and ^{15}N(p,^{3}He)^{13}C reactions, these calculations were carried out using intermediate coupling wave functions to describe the final state; for the ^{13}C(p,t)^{11}C and ^{13}C(p,^{3}He)^{11}B reactions, pure jj configurations were assumed. In addition to giving a good account of the observed angular distributions, the DWBA calculations of relative cross sections for the (p,t) transitions were also found to be in good agreement with experiment. Dissert. Abstr.

N69-17891 Illinois Univ., Urbana.
MEASUREMENT OF THE RELATIVE PARTIAL DECAY RATES FOR POSITIVE AND NEGATIVE KAONS YIELDING POSITIVE AND NEGATIVE PIONS, POSITIVE PION, AND NEGATIVE PION
Charles Roberts Fletcher (Ph.D. Thesis) 1967 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-8073

A spark chamber experiment was performed at the Argonne National Laboratory Zero Gradient Synchrotron to measure the relative partial decay rates of positive and negative kaons decaying in the tau mode, $K^\pm \rightarrow \pi^\pm + \pi + \pi^-$. The tau decays were observed by photographing the three pions in spark chambers. The kaons in a beam derived from the external proton beam were identified by a threshold and a differential gas Cerenkov counter. The film taken was scanned twice for taus. The identifiying feature of a tau was three particles from a common vertex with no particle making an angle of greater than 10° with the direction of the decaying kaon. The two scans were checked frame by frame for conflicts in interpretations. Dissert. Abstr.

N69-17914 Illinois Univ., Urbana.
THREE PARTICLE EFFECTS IN THE PAIR DISTRIBUTION FUNCTION FOR He-4 GAS
Harry Frederick Jordan (Ph.D. Thesis) 1967 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-8126

The diagonal elements of the 3-particle density matrix for He^4 have been formulated in terms of Wiener functional integrals in order to compute both that part of the pair distribution function linear in the density and the third virial coefficient. The 3-particle interaction energy was taken to be a sum of Lennard-Jones potentials between pairs of particles. Evaluation of the Wiener integrals was carried out by a Monte Carlo sampling technique to yield the pair distribution function and third virial coefficient for

temperatures from 273°K to 5°K. Comparison of the linear portion of the density expansion of the pair distribution function gave qualitative agreement with experimental values for the pair distribution function in liquid He^4 measured by neutron diffraction. Dissert. Abstr.

N69-17916 Florida State Univ., Tallahassee.
EXPERIMENTAL STUDY OF THE $T_<=T_z$ STATES IN Zr 90 VIA A (He 3, d) REACTION
George Vourvopoulos (Ph.D. Thesis) 1967 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-7802

The $^{89}Y(^3He,d)^{90}Zr$ data taken with the Oak Ridge isochronous cyclotron with E^3_{He} = 25 MeV are analyzed. Previously seen states at 0.0, 1.76, 2.32, 2.73 MeV are used as a check on the analysis. Six l_p=1 states are found in the vicinity of 4.5 MeV excitation, and this is plausible only if the ground state of ^{89}Y is not pure $p_{1/2}$. The 37 states are observed between 5.08–8.12 MeV excitation with l_p=2 and l_p=0. These states are considered to be the $T_<=T_z$ single particle-hole states of the $p_{1/2}{}^{-1}d_{5/2}$, $p_{1/2}{}^{-1}$, and $p_{1/2}{}^{-1}d_{3/2}$ proton configuration in ^{90}Zr. The possibility exists that there are some additional states of the $p_{1/2}{}^{-1}d_{3/2}$ proton configuration higher than 8.12 MeV. The energy separation between the centroid of each of the $T_<=T_o-1/2$ groups and the corresponding analogues with $T_>=T_o+1/2$ is found to be approximately 7 MeV. Dissert. Abstr.

N69-17927 Missouri Univ., Rolla.
CELL MODEL OF A FLUID WITH HARD CORE REPULSIVE LONG RANGE ATTRACTIVE POTENTIAL
Ralph Gunther Tross (Ph.D. Thesis) 1968 348 p
Avail: Univ. Microfilms: HC $15.75/Microfilm $4.45 Order No. 68-8316

A model of a one-dimensional fluid is investigated in which the particles are embedded in a cellular space grid and interact with a modified Lennard–Jones potential. It is shown that with an appropriate change in the potential function the model is also suitable for a two- or three-dimensional fluid with more restricted interactions. A method is found for linearizing the partition function which results in a useful series solution. The series solution is shown to offer a convenient and unified method for obtaining, algebraically, correct low-temperature expansions of the partition function for two- and three-dimensional fluids with nearest-neighbor interactions and similar potentials incorporating only a limited number of bonds. Dissert. Abstr.

N69-17938 Michigan Univ., Ann Arbor.
SU(6) INVARIANCE IN S-WAVE MESON BARYON SCATTERING
David Crockett Carey (Ph.D. Thesis) 1967 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-7571

SU(6) has been incorporated into a simple model of multi-channel amplitude for s-wave scattering of mesons in the 35 representation by baryons in the 56. Symmetry breaking is introduced by making the amplitude satisfy unitarity exactly in the direct channel. The contributions to the amplitude from the crossed channel singularities are assumed to be SU(6) invariant and can be expressed in terms of the product of four scattering lengths times appropriate projection matrices. Fits of the model have been made to the threshold parameters of πN, KN, and $\bar{K}N$ scattering. Several solutions have been found and a comparison of calculated threshold parameters, cross sections and phase shifts with experimental data is made. Calculations of resonances predicted by the model are performed and found to be in good agreement with experimental results. Dissert. Abstr.

N69-17945 Washington Univ., Seattle.
AN EXPERIMENTAL STUDY OF LOW ENERGY PROTONS FOLLOWING DEUTERON INDUCED REACTIONS: SPECTRAL FLUCTUATIONS AND DECAY FROM ISOBARIC ANALOGUE STATES
Nelson Wong Cue (Ph.D. Thesis) 1967 237 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 68-9271

Low energy protons (2.5 – 10 MeV) from deuteron induced reactions on various targets were studied with the use of a ΔE-E detector telescope having a combined energy resolution of about 34 keV. In the first part of this work, the reaction leading to the continuum states was investigated in detail at deuteron energies around 16.5 MeV in an attempt to search for spectral fluctuations, i.e., fluctuations in the particle spectra corresponding to the continuum states in the residual nucleus. Dissert. Abstr.

N69-17948 Florida State Univ., Tallahassee.
A THREE BODY MODEL OF THE DEUTERON OPTICAL POTENTIAL
Jerry Louis Ziegler (Ph.D. Thesis) 1967 186 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-7806

Deuteron scattering from complex nuclei was examined. The nuclear potential for each nucleon in the deuteron was represented by the optical model potential used in nucleon scattering from the same target nucleus. The three-body Schrodinger equation was expanded into a perturbation series. The first order term was qualitatively identified as the local potential corresponding in magnitude with the simple sum of the nucleon optical potentials. Second order terms were calculated using a high speed computer in order to try and derive an unambiguous magnitude for the effective deuteron optical potential. Using physical values for the nucleon potential in the cases of ^{55}Fe and ^{60}Cu the calculated deuteron potential was found to be affected by as much as 25% by the second order terms. It was found that the second order terms for each partial wave decreased relative to first order terms as the deuteron energy was increased. The results suggested that the deuteron potential for 10–20 MeV deuterons has a magnitude of about 130 MeV for a radius parameter of about 1.15 F. The non-locality and partial wave dependence of the second order terms was investigated and found to be very complicated; a strong parity dependence was observed. Dissert. Abstr.

N69-17952 Washington Univ., Seattle.
COSMIC RAY MUON STUDIES UNDERGROUND
Don Marion Cottrell (Ph.D. Thesis) 1967 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-9268

The inelastic scattering of high-energy muons from emulsion nuclei was measured using the beam of high energy penetrating muons underground. Stacks of Ilford G-5 emulsion were manufactured, exposed, and developed underground at several locations. Altogether 429 cubic centimeters of nuclear emulsion were scanned for nuclear interactions. Within this scanned volume a total of 426 nuclear disintegrations were found of which 104 were classified as muon scattering events. The cross section for muon interactions was found to depend upon depth, increasing from 2.87 microbarns under 3100 grams of rock to 8.28 microbarns under 7800 grams of rock. The angular distribution of the incident muon flux was measured and found to also depend upon depth, being more strongly peaked toward the vertical at greater depth. The cross section for muon scattering increases with zenith angle, as does the relative abundance of high energy muons. Dissert. Abstr.

N69-17963 Virginia Polytechnic Inst., Blacksburg.
HALF-LIFE DETERMINATION OF LUTETIUM-176 BY THREE COINCIDENCE METHODS
Ronald Ross Winters (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-8998

It was shown that when the geometry of the counting arrangement is taken into account, both gamma-gamma and beta-gamma coincidence techniques yield values for the half-life which are in agreement to within the experimental errors. The techniques of gamma-gamma and beta-gamma coincidence were applied to extended source counting geometries for sources of nonuniform density. Equations were developed which were solvable for the activity of the source and which provided a quantitative estimate of the effects of the divergence from a point source geometry. The average value as determined in the present work for the half-life was $(2.171 \pm 0.023) \times 10^{10}$ year. When the gamma energy spectrum was examined, only those photopeaks expected on the basis of the proposed decay scheme were observed. This supported the conclusion that the decay scheme, as proposed, satisfactorily describes the Lu^{176}-Hf^{176} decay. Dissert. Abstr.

N69-17967# Pennsylvania Univ., Philadelphia.
PION PION SCATTERING INFORMATION FROM PION N YIELDS PION PION N
W. Selove Jul. 1968 29 p refs Presented at Conf. on Exptl. Meson Spectry., Philadelphia, Pa., Apr. 1968
(Contract AT(30-1)-2171)
(NYO-2171-250; CONF-680428-13) Avail: CFSTI

Some recent attempts to determine $\pi\pi$ phase shifts from the reaction $\pi^- p \rightarrow \pi\pi N$ are reviewed. Author (NSA)

N69-17968# Oak Ridge National Lab., Tenn.
BACKWARD NEUTRON YIELD FROM A SHIELD UNDER THE INFLUENCE OF PROTONS OF 660 MeV ENERGY
L. R. Kimel, M. M. Komachkov, V. P. Sidorin, B. S. Sychev, and A. P. Charevatenko [1968] 16 p refs Transl. into ENGLISH from the report JINR-P16-3514
(ORNL-tr-1913) Avail: CFSTI

Back yield of neutrons from the concrete shielding is measured (ρ = 2.35 g/cm^3). The beam of 660-MeV protons was directed normally to the shielding surface. The experimental data are compared with calculations. Author (NSA)

N69-17976*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HARTREE-FOCK CALCULATIONS WITH WOOD-SAXON BASIS FUNCTIONS
William F. Ford and Richard C. Braley Washington Feb. 1969 25 p
(NASA-TN-D-5066) Avail: CFSTI CSCL 20H

Hartree-Fock method is used to study the even-even N = Z nuclei in the 2s-1d shell. Basis functions with correct asymptotic behavior are generated by use of a Wood-Saxon well. The results are compared with calculations using the conventional harmonic oscillator basis. It is found that most of the Wood-Saxon results may be obtained with a harmonic oscillator basis if the oscillator parameter is carefully chosen. Author

N69-17980 California Univ., San Diego.
TOWARDS A THEORETICAL TREATMENT OF DIFFUSION IN LIQUIDS
Harold Joseph Raveche (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order 68-9169

For a liquid system of monatomic molecules near equilibrium, a method is presented for obtaining the diffusion coefficient in terms of functions of molecular properties. The approach considers the reduced probability density functions for n molecules in the limit of a steady state for which W_n is independent of time. The reduced probability densities and the average vector force are developed as a power series in small parameter. A singlet momentum dependent force which maintains the flux and gradient stationary in time is determined. The average molecular pair force which maintains the liquid in a steady state is computed. From symmetry requirements a correction to the Kirkwood closure for the nonequilibrium factors in the triplet probability density is obtained. The closure fixes the ratio between the assumed density gradient anf flux of molecules, which leads to the diffusion coefficient in terms of functions of pairs and triples of molecules and the intermolecular potential energy. Dissert. Abstr.

N69-17987# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON CORRECTIONS OF ORDER alpha Z TO MUON CAPTURE IN C-12
Z. Ozevich and A. Pikulski 1968 9 p refs
(JINR-E4-4034) Avail: CFSTI

The result of the calculation of the partial muon capture in $^{12}C + \mu^- \rightarrow {}^{12}B$ (g.s.) reactions, including all effects of the order αZ is given. These effects are shown to be for $C_p/C_A = 8$, a 10% correction in the capture rate and a +2% correction in comparison with the result of Morita and Fujii. Author (NSA)

N69-18050# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi I Eksperimental'noi Fizik.
IDENTIFICATION OF THE MECHANISM OF STRAIGHT PROCESSES WITH THE FORMATION OF THREE PARTICLES [IDENTIFIKATSIYA MEKHANIZMA PRYAMYKH PROTSESSOV S OBRAZOVANIEM TREKH CHOSTITS]
I. S. Shapiro and V. M. Kolybasov 1968 26 p refs In RUSSIAN
(ITEF-591) Avail: CFSTI

The identification of reaction mechanisms is discussed. Both the types of experiments and the methods of data analysis that are required to determine reaction mechanisms are considered. It is pointed out that even for such thoroughly studied reactions as the (p,2p) reaction, insufficient information has been obtained to permit independent variables under conditions that permit comparison with theory is emphasized. NSA

N69-18051# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
REACTIONS NI SUP 58, 60, 62, 64 (d,n) CU SUP 59, 61, 63, 65 AND ZN SUP 64, 66, 68 (d,n) GA SUP 65, 67, 69 [REAKTSII NI 58, 60, 62, 64 (D,N) CU 59, 61, 63, 65 ZN 64, 66, 68 (D,N) GA 65, 67, 69]
V. V. Okorokov, V. P. Bochin, V. S. Pomanov, V. M. Serezhin, V. A. Smotrysev et al 1968 31 p refs In RUSSIAN; ENGLISH summary
(ITEF-595) Avail: Issuing Activity

The proton states of ^{59,61,63,65}Cu and ^{65,67,69}Ga were investigated in (d,n) reactions on ^{58,60,62,64}Ni and ^{64,66,68}Zn. The neutron spectra were measured using time-of-flight method. The values lp and $(2j+1)C^2S$ for resolved levels were calculated in the distorted-wave approximation. Author (NSA)

N69-18052# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi I Eksperimental'noi Fiziki.

CONNECTION BETWEEN QUANTUM MECHANICS AND LOBACHEVSKY GEOMETRY OF SPACE [SVYAZ'KVANTOVOI MEKHANIKI S GEOMETRIEI PROSTRANSTVA LOBACHEVSKOGO]

V. A. Kolkunov and V. I. Rostokin 1968 28 p refs In RUSSIAN; ENGLISH summary

(ITEF-613) Avail: Issuing Activity

It is shown that approximate solution of the one-dimensional Schroedinger equation, by representing the potential as a set of steps, leads to the concept of multiplicative integral. To analyze the latter, graphical schemes of calculations are developed. In a study of the problem of passage of the waves through the field force, the parametrization of the S matrix through the Euler angles is used, and the connection between the solution of the equation and the Lobachevsky geometry is established. Author (NSA)

N69-18055 Arkansas Univ., Fayetteville.

DISTRIBUTION OF MASS IN THE FISSION OF BISMUTH 209, THORIUM 232, URANIUM 233 AND PLUTONIUM 242

Ramachandran Ganapathy (Ph.D. Thesis) 1968 85 p

Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-9663

Bismuth was found to undergo fission with 14.8 MeV neutrons. The fission cross-section at this neutron energy was found to be $(3.5 \pm 1.0) \times 10^{-32}$ cm^2. Radiochemical measurements that have been made of the fission yields of ten mass chains from the fission of Th^{232} by 14.8 MeV neutrons indicated the presence of a third peak in the mass-yield curve. Fission yields of fifteen mass chains have been measured from the fission of U^{233} by thermal neutrons using improved radiochemical techniques with emphasis placed on the fine structure region. A = 131–135. The results indicate the absence of any pronounced peak in the fine structure region. Dissert. Abstr.

N69-18056*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

IONIZATION OF EXCITED ATOMIC HYDROGEN BY FAST ELECTRONS

Kazem Omidvar Dec. 1968 63 p refs

(NASA-TM-X-63434; X-641-68-505) Avail: CFSTI CSCL 20J

Electron impact ionization cross section, energy distribution and the average energy of the ejected electrons for the first five principal quantum numbers of atomic hydrogen, and all the azimuthal quantum numbers, are calculated within the Born approximation. Calculations are extended to a range of 100 to 900 threshold units of energy. Regions of agreement and disagreement between the high energy quantal and classical calculations are analyzed. Validity of the Born approximation for excitation and ionization for a single particle model is given. An energy spectrum of the secondary electrons due to the passage of an energetic electron in a hydrogen atom gas is found. Author

N69-18072# Maryland Univ., College Park. Dept. of Physics and Astronomy.

ISOBARIC-ANALOGUE STATES OF Be 10 AND B 10

M. L. Roush, F. C. Young, P. D. Forsyth, and W. F. Hornyak Dec. 1968 54 p refs Supported in part by AEC

(TR-919) Avail: Issuing Activity

A study was made of the 5.96- and 6.26-MeV levels of ^{10}Be. Electromagnetic transitions following the $^{9}Be(d,p)^{10}Be$ reaction were examined. Spectra in coincidence with the proton groups were analyzed to determine γ-ray branching ratios. A γ–γ correlation measurement was made upon the cascade γ rays from both states, and the result was consistent with J = 2 for both states. The correlation observed for the decay of the 5.96-MeV state is not consistent with that of a 1 − state. However, it is suggested that a $1^- - 2^+$ doublet exists at 5.96 MeV in ^{10}Be with the J = 2 member decaying predominately by cascade through the 3.37-MeV state; and the J = 1 member decaying predominately by a direct ground state transition. Experimental confirmation of the doublet structure at 5.96 MeV was obtained and a level separation of 1.6 ± 0.5 keV determined, with the 2^+ level being lower in excitation. Proton angular distributions at 2.8-MeV deuteron energy were determined for the individual members of the doublet to establish the parities of the states. Author

N69-18080 Michigan Univ., Ann Arbor.

THE DOORWAY STATE THEORY OF NEUTRON-NUCLEAR REACTIONS

Kenji Takeuchi (Ph.D. Thesis) 1967 246 p

Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-7740

The purpose of this study is to extend the doorway state theory for neutron-nuclear reactions in the energy region below 10 MeV. The importance of the doorway state arises from the fact that the deviation of the optical model calculations may be explained in terms of the doorway state, and that it is one of the internal degrees of freedom of the compound nucleus. The effects of the doorway states on the complex potential are determined with a resulting generalization of the optical model. The intermediate structure of cross sections is represented in terms of the doorway state formation and decay probabilities. The fine structure of doorway states is developed for determination of the dynamical constants of the doorway state, for shape study of the cross sections, and for discussion of the bumps in the cross sections in the continuum energy region. A shell model calculation of the doorway state formation probabilities of Ni-58 is presented. Dissert. Abstr.

N69-18086 Louisiana State Univ., Baton Rouge.

QUANTUM MECHANICAL CALCULATIONS OF: AZABENZENES, ETHYLENE, HYDROGEN DISULFIDE

Brent J. Bertus (Ph.D. Thesis) 1968 111 p

Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-10720

Semi-empirical molecular (Mulliken-Wolfsberg-Helmholtz and V.E.S.C.F.) orbital calculations on pyridine are reported. Open shell computations on configurations resulting from $\pi \rightarrow \sigma^*$ and $n \rightarrow \pi^*$ MO excitations have been performed and it has been shown that significant charge redistribution effects occur in the latter instance. In particular, it has been found that the $^1A_{\pi\sigma^*}$ configuration is of lower energy than the $^1A_{\pi\pi^*}$ configuration. The origins of the "mystery band" in ethylene are discussed using (M-W-H) open shell computation methods. The "anti-Berry" state $\pi \rightarrow \sigma^*$ is found to be of lower energy than either the $\pi \rightarrow \pi^*$ or the Berry $\sigma \rightarrow \pi^*$ transitions. Hydrogen disulfide ground state energy as a function of dihedral angle (θ) is reported. The barrier to internal rotation was found to be 2.6 Kcal/mole. Origins for the first unfilled MO's in H_2S_2 were reviewed. Dissert. Abstr.

N69-18091# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik und Reaktortechnik.

ORGANIZATIONAL AND TECHNICAL ASPECTS IN THE FIELD OF NEUTRON NUCLEAR DATA EVALUATION

J. J. Schmidt Jul. 1968 12 p refs Presented at the 1st Intern. CODATA Conf., Tsenus, Ger., 30 Jun.–5 Jul. 1968

(KFK-791; CONF-680636-1) Avail: CFSTI

A brief outline of the organizational and technical aspects of the evaluation of neutron data is presented. NSA

N69-18098 Michigan Univ., Ann Arbor.
ON EIGHT DIMENSIONAL QUASISPIN
Sing-Chin Pang (Ph.D. Thesis) 1967 212 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-7689

The present work formulates the exact solution of the pairing problem in the Ω(spatial) - ST scheme in terms of the matrix elements of the pair creation and annihilation operators coupled to zero spatial angular momentum quantum number. The mathematical formulation of the problem has involved the study of an orthogonal group in eight dimensions, the so-called quasispin group. A sample calculation has been carried out for the case of a pairing interaction of variable strength connecting two single particle levels similar to those of the s-d shell. The results show that (1) the pairing interaction is very effective compared with the particle energy and wins out in the competition with the single particle excitations for all but the weakest pairing strengths, (2) the pairing interaction tends to make more stable those states built from the largest possible number of α-like groupings of four particles. Dissert. Abstr.

N69-18099 Michigan Univ., Ann Arbor.
LONG RANGE ELECTROSTATIC AND ELECTROMAGNETIC INTERACTIONS BETWEEN ATOMS
Jose Luis Martinez Cortez (Ph.D. Thesis) 1967 222 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 68-7579

The object of this calculation is to examine the contribution to the interaction energy between two neutral hydrogenic atoms in their ground state due to their electrostatic interaction and the presence of an electromagnetic radiation field in its vacuum state. The separation distance between the atoms is large in comparison with atomic dimensions and is of the order of the transitions. Thus, the atoms are sufficiently separated so that the overlapping of their respective charge distributions is neglected along with spin. The problem is then handled using nonrelativistic quantum electrodynamics. The interaction energy is obtained accurate to quadrupole-quadrupole orders. The results are given as corrections to the various electrostatic multipoles corresponding to the dipole–dipole, dipole–quadrupole and quadrupole–quadrupole interactions between the atoms. Dissert. Abstr.

N69-18111*# National Aeronautics and Space Administraion. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER ANALYSIS OF TRACKS IN NUCLEAR EMULSION UTILIZING DIGITIZED VIDEO SCAN
C. H. Ehrmann and D. V. Reames Nov. 1968 15 p refs
(NASA-TM-X-63405; X-611-68-438) Avail: CFSTI CSCL 20H

A system has been developed to make density measurements on particle tracks in nuclear emulsions. The output signal of a videcon viewing the track through a microscope is digitized to detect developed grains in the emulsion. This digitized information is transferred in real time to a computer which selects grains falling in the track and sums their volumes and computes parameters related to their spatial distribution. Analysis of tracks at arbitrary angles is accomplished by rotating the track image in the focal plane with a Pechan prism and by driving the focal plane through the emulsion while taking data. Author

N69-18112# Paris Univ., Orsay (France). Institut de Physique Nucleaire.
APPROXIMATIONS IN THE CALCULATION OF PROTON-DEUTERON ELASTIC SCATTERING AT MEDIUM ENERGY [APPROXIMATIONS DANS LE CALCUL DE LA DIFFUSION ELASTIQUE PROTON-DEUTERON A MOYENNE ENERGIE]
M. L'Huillier [1968] 14 p refs In FRENCH; ENGLISH summary
(IPNO/LA-3) Avail: CFSTI

The usual calculations of the proton-deuteron elastic scattering cross section are analyzed for energies of about 100 MeV. Several approximations usually made in the impulse term, such as the factorization method and the introduction of the free nucleon–nucleon scattering operator (on the energy shell), are studied. The use of a simple separable S interaction allows derivation of a ratio between the exact and approximate values of the impulse approximation term. The variations with the incident energy or the center-of-mass angle are small, and the corrections are not greater than 10%. This result is due to the properties of the deuteron wave function. It is concluded that these approximations are not responsible for the observed disagreement with respect to experiments and that consequently a multiple scattering mechanism must be involved. NSA

N69-18114# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
STRAGGLING DISTRIBUTIONS OF EXTREMELY LARGE ENERGY LOSSES BY HEAVY PARTICLES
C. Tschalaer Mar. 1968 28 p refs
(RHEL/R-164) Avail: CFSTI; UK 4s 6d

Previous calculations of straggling distributions based on expansions into higher moments are re-examined. They are shown to break down for proton energy losses of over 80% due to particles being stopped completely. By direct integration of simplified propagation equations distribution calculations are continued up to particle losses of 50%. Author (NSA)

N69-18115 Minnesota Univ., Minneapolis.
THE MEASUREMENT OF NUCLEAR MATTER RADII IN THE TIN ISOTOPIC SEQUENCE
Richard Nelson Boyd (Ph.D. Thesis) 1967 112 p refs
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No 68-7280

Differential cross sections and polarization of 39.6 MeV protons elastically scattered from ^{116}Sn, ^{118}Sn, ^{120}Sn, ^{122}Sn, and ^{124}Sn were measured. The measurements were performed using proton linear accelerator and polarized proton source. The data were then analyzed using reformulated optical model to extract the root mean square matter radii in this isotopic sequence. The root mean square matter radii and the approximate errors determined are for ^{116}Sn, 5.14 ± .08 f; for ^{118}Sn, 5.19 ± .09 f; for ^{120}Sn, 5.16 ± .08 f; for ^{122}Sn, 5.19 ± .08 f; and for ^{124}Sn, 5.25 ± .07 f. Since the isotopic range from ^{116}Sn to ^{124}Sn includes 98% of natural tin, the nuclear matter distribution is significantly larger than the nuclear charge distribution, as determined by Acker, et al. Dissert. Abstr.

N69-18144# Argonne National Lab., Ill.
CALCULATION OF dE/dx AND ENERGY LOSS DISTRIBUTIONS IN SPHERICAL CAVITIES FOR MONOENERGETIC NEUTRON FIELDS
Robert F. Dvorak May 1968 19 p refs
(Contract W-31-109-ENG-38)
(ANL-7454) Avail: CFSTI

A computer program has been prepared that calculates the average dE/dx and energy loss for events occurring in a spherical cavity due to incident monoenergetic neutrons. No assumptions are made as to distribution of path lengths. The particle paths are traced and a range-energy equation is used to calculate the cavity energy loss and average dE/dx for each event. The distribution in pulse height for events having the same average dE/dx and the neutron energy, and to deviate from the commonly postulated triangular distribution at neutron energies below 1 MeV for a cavity with a diameter of 2.08 m. Pulse-height distributions and dose distributions in average dE/dx for several energies have been computed. From the pulseheight distributions, LET distributions were calculated by the Rossi–Rosenzweig technique and compared

with the computed average dE/dx distribution. The weighting factor relating energy loss and deposited dose equivalent for an event, as used with the survey instrument proposed by Baum, was also computed. Author (NSA)

N69-18163# Michigan Univ., Ann Arbor. Dept of Physics.
SU(3) TECHNIQUES FOR SHELL MODEL STUDIES AND THE SPECTRA OF A EQUAL 25 NUCLEI
John D. Vergados Sept. 1968 126 p refs
(Contract Nonr-1224(59))
(AD-679764; Rept-07591-2-T) Avail: CFSTI CSCL 20/8

The shell model as a useful approximation to the many body theory of the nuclei is discussed. Within the limits of the Pauli principle each particle interaction can be approximated by an average single particle potential. Added symmetries are introduced by specific assumptions and approximations of the applied Hamiltonian. Emphasis is given to experimental and predicted energy levels of Al25 and Mg25. F.O.S.

N69-18184# European Organization for Nuclear Research, Geneva (Switzerland).
ON THE NON-LINEAR THEORY OF A HYDRODYNAMIC BEAM INSTABILITY
B. Shichinov et al May 1968 8 p refs Transl. into ENGLISH from JINR rept. JINR-P9-3690, 1968
(CERN-TRANS-68-6; JINR-P9-3690) Avail: CFSTI

The effect of the nonlinear interaction of harmonics on the quasilinear relaxation of an aperiodic beam instability is estimated. Author (NSA)

N69-18187# International Centre for Theoretical Physics, Trieste (Italy).
ARGAND DIAGRAMS, BOOTSTRAP THEORIES AND REGGE POLES
V. A. Alessandrini and E. J. Squires May 1968 7 p refs Submitted for publication
(IC-68-37) Avail: CFSTI

It is discussed, whether all resonances should be expected to occur in the partial wave projection of the cross-channel Regge pole formula, because these contain near circles of resonance type. ESRO

N69-18197# Naval Research Lab., Washington, D.C.
INELASTIC ELECTRON SCATTERING AT 180 DEGREES FROM MAGNESIUM-25
L. W. Fagg, W. L. Bendel, E. C. Jones, Jr., and H. G. Kaiser *In its* Rept. of NRL Progr. Nov. 1968 p 1-2 refs (See N69-18968 07-24)
Avail: CFSTI

The usefulness of 180 degree inelastic electron scattering in the study of the rotational properties of odd-A distorted nuclei is demonstrated for magnesium-25. For the 1.61-MeV transition, the ground-state radiative width and the transition radius were found to be 0.059 eV and 2.8 fm, respectively. Author

N69-18212# International Centre for Theoretical Physics, Trieste (Italy).
EXTINCT BOUND STATES AND THE EXTENSION OF LEVINSON'S RELATION
M. Stihi Jun. 1968 9 p refs Submitted for publication
(IC-68-45) Avail: CFSTI

Using the generalized Jost function formalism in the most general case, when the phase shift at infinity may be even a non-integral multiple of π, the extension of Levinson's relation is deduced. This relation reduces to that obtained by Warnock in the ND-1 formalism, when a supplementary restriction, that no extinct bound states are present, is imposed. Moreover, a way of improving a practical calculation of the generalized Jost function is given so that the final solution be free of undesirable extinct bound states. ESRO

N69-18221# International Centre for Theoretical Physics, Trieste (Italy).
A SIMULTANEOUS PARTIAL-WAVE EXPANSION IN THE MANDELSTAM VARIABLES: THE GROUP SU(3)
A. P. Balanchandran (Syracuse Univ.), W. J. Meggs (Syracuse Univ.), J. Nuyts (Paris Univ., Orsay), and P. Ramond Jun. 1968 19 p refs
Submitted for publication
(IC-68-46) Avail: CFSTI

The elastic scattering amplitude of two spinless particles of equal mass 1/2 was expanded elsewhere in a double series of eigenfunctions which displayed its dependence on all the Mandelstam variables s,t,u ($s+t+u=1$). The expansion was then used to investigate the crossing properties of partial-wave amplitudes. It is shown that these eigenfunctions are certain base vectors of the representations (σ,σ) of a suitably defined SU(3). The unequal mass problem is also discussed. Author (ESRO)

N69-18222# International Centre for Theoretical Physics, Trieste (Italy).
A SIMPLE EXTENSION OF THE BCS METHOD FOR WEAKLY DEFORMED NUCLEI
J. Hendekovic Jun. 1968 15 p refs Submitted for publication
(IC-68-41) Avail: CFSTI

The BCS gap equation is extended to the case of weakly deformed nuclei in such a way that a spheroidal deformation can be expressed in the spherical base by means of the non-spherical distribution of occupation probabilities. The extension is made so that the consistency condition is satisfied, i.e., that a density of particles follows a deformation of the average field. The problem of including a resistance of the core to deformations is discussed and a numerical illustration of the method presented is given. Author (ESRO)

N69-18230# International Centre for Theoretical Physics, Trieste (Italy).
MICROSCOPIC THEORY OF EFFECTIVE OPERATORS OF ELECTROMAGNETIC INTERACTIONS IN NUCLEI
M. Gmitro, A. Rimini (Trieste Univ.), J. Sawicki, and T. Weber (Trieste Univ.) Jun. 1968 37 p refs Sponsored in part by Ist. Nazl. di Fis. Nucl. Submitted for publication
Submitted for publication
(IC-68-42) Avail: CFSTI

Effective operators for valence (open-shell) nucleons only are constructed for electromagnetic interactions in nuclei. Such operators are calculated in terms of excitations and de-excitations of particle-hole pairs of the core nucleons. The nuclear force involved is a realistic nucleon-nucleon potential (Yale-Shakin). The theory is applied to the Sn region described in terms of five valence neutron subshells and of all the core and open subshells of both the neutrons and protons between the magic numbers 8 and 126. A good semiquantitative agreement with all the corresponding experimental data is obtained. The reported calculations involve no ad hoc adjustable parameter. Author (ESRO)

N69-18232# International Centre for Theoretical Physics, Trieste (Italy).
ELASTIC AND QUASIFREE ELECTRON SCATTERING FROM C-12 AND PROJECTED HARTREE-FOCK WAVE FUNCTIONS

S. Boffi (Pavie Univ.), M. Bouten (C.E.N.), C. Ciofi degli Ati (Rome Ist. Super di Sanita), and J. Sawicki May 1968 18 p refs Submitted for publication
(IC-68-38) Avail: CFSTI

Projected Hartree-Fock wave functions are obtained for ^{12}C and ^{11}B using Volkov's force. The elastic electron scattering form factor and the angular and energy distributions for the high-energy ^{12}C (e,e'p) reaction are calculated. While a good agreement is obtained with the observed elastic form factor, only a slight improvement over previous shell-model results is obtained for the quasifree scattering data. The relatively large deformation of the Hartree-Fock field has only a negligible effect on the calculated form factors. Author (ESRO)

N69-18239#
RESONANCE RADIATION TRANSFER IN A FINITE LAYER
Iu. A. Popov 1968 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektr. (USSR), v. 9, no. 5, 1968 p 802-806
Avail: CFSTI

An approximate solution of the problem of resonance radiation transfer was examined for a plane finite layer. Equations were solved for the passage of high intensity monochromatic radiation through a layer containing two level molecules with a natural frequency equal to the frequency of the incident radiation. A comparison of the exact solutions showed that the mean error in determining the intensity was about 2%. B.P.

N69-18241# International Centre for Theoretical Physics, Trieste (Italy).
AN EXTENSION OF JASTROW'S METHOD FOR THE QUANTUM MECHANICAL MANY-BODY PROBLEM WITH STRONG FORCES
S. Ali, M. E. Grypeos, and L. P. Kok Jul. 1968 17 p refs Supported in part by Greek AEC
(IC-68-62) Avail: CFSTI

An extension of Jastrow's method for the treatment of the quantum mechanical many-body problem with strong forces is proposed. A system of N identical particles (nucleons) to which two additional particles S have been attached is considered and a detailed study is performed by using cluster expansion techniques. A trial expression for $E_{S_1S_2}$, the energy required to separate the two extra particles from the system and from each other, is derived and some possibilities are discussed. ESRO

N69-18246# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
REGGE POLES IN HIGH-ENERGY SCATTERING
H. J. Lubatti [1968] 68 p refs Prepared in Cooperation with MIT
(LAL-1197) Avail: Issuing Activity

Some of the recent results obtained in high energy interactions of hadrons and the relevance of the Regge pole model to these data are reviewed. NSA

N69-18251# International Centre for Theoretical Physics, Trieste (Italy).
SOME ROTATION FUNCTIONS OF REGGEIZED SU(6)×SU(6)
Harun-Ar Rashid Jun. 1968 14 p refs Submitted for publication
(IC-68-39) Avail: CFSTI

The d-functions of the Reggeized SU(6)×SU(6) scheme necessary for the application of the method in meson-baryon scattering are presented. Author (ESRO)

N69-18252# International Centre for Theoretical Physics, Trieste (Italy).
A THEORY OF THE HEAVY ELECTRON
A. O. Barut, P. Cordero, and G. C. Ghirardi (Trieste Univ.) Sep. 1968 17 p refs Submitted for publication
(IC-68-89) Avail: CFSTI

Quantum electrodynamics with a generalized minimal conserved current of the form $j_\mu = \alpha_1 \gamma_\mu + \alpha_\mu P_\mu$ is investigated. Fixing the value of α_2 by the anomalous magnetic moment of the electron (muon) we obtain an excited state of mass $m' = (1+4\pi/\alpha)m$, [881 MeV for e'], and of magnetic moment 3 in units of $1/2m'$, that can decay to the ground state. The excited state has negative norm, but can be made entirely consistent in the second quantized theory. The equations are interpreted as those describing a partly "dressed" particle, thus a new form of the perturbation series is suggested. Author (ESRO)

N69-18253# International Centre for Theoretical Physics, Trieste (Italy).
RADIALLY EXCITED MESONS
P. G. O. Freund Jun. 1968 11 p refs Supported in part by A.E.C. Submitted for publication
(IC-68-47) Avail: CFSTI

A relativistic theory of mesonic radial excitations is constructed using the oscillator-like rest symmetry group U(6)×U(6)×U(3) and its collinear group $U(6)_W U(2)_R$. As applications and tests, predictions concerning the decays and photoproduction of mesons in the R-region are made. Author (ESRO)

N69-18254# International Centre for Theoretical Physics, Trieste (Italy).
EIGENVECTORS FOR THE PARTIAL-WAVE CROSSING MATRICES
A. P. Balachandran (Syracuse Univ.), W. J. Meggs, and P. Ramond (Syracuse Univ.) Jun. 1968 14 p refs Supported jointly by the U.S. A.E.C. and N.D.E.A.
(IC-68-44) Avail: CFSTI

Let a,b,c,d be spinless particles of equal mass and consider the process a+b→c+d. It was shown elsewhere that the crossing symmetry of the scattering amplitude for such a process implies an infinite number of finite-dimensional crossing relations for the associated partial waves. In this paper, an explicit expression for complete orthogonal and biorthogonal sets of eigenvectors of the partial-wave crossing matrices is derived. The general form of partial wave which is consistent with crossing symmetry is thus determined. Author (ESRO)

N69-18256# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
COMPUTER SIMULATION OF ORDER-DISORDER PHENOMENA
Naofumi Ogita, Akira Ueda, Takeo Matsubara, Hirotsuga Matsuda, and Fumiko Yonezawa Dec. 1968 17 p refs
(RIFP-81) Avail: CFSTI

An idealized model system is chosen in which the second-order phase transition can take place; the microscopic initial state of the system is fed into a computer as bit information, the computer is taught the rules by which the time development of the microscopic states is determined. Thereafter, the computer simulates the time development of the memorized microscopic state. The average of the physical quantities of the model system and even the microscopic state itself may be output at any moment during the calculations. Changing environmental conditions such as temperature, external field, and so on, effects the experiment. By means of this simulation the existence of an anomalously slow relaxation phenomenon near the transition point is confirmed, and moreover what type of microscopic behaviour caused this anomaly is ascertained. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-18273 Oklahoma Univ., Norman.
EXCITATION PROCESSES IN HELIUM
John Dewey Jobe (Ph.D. Thesis) 1968 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-9039

Helium gas has been bombarded by electrons under controlled conditions of pressure, temperature, electron energy, and beam current. Radiation rates from 51 transitions have been measured over the spectral range of 3230 to 20,582 A. The apparent cross sections of the 2 P and 2 3P states have been examined in the light of new and detailed information concerning the states which cascade to the 2P states. Excitation functions have been obtained for the 2P states from onset to 500 eV and for 22 of the cascading states near onset. Cascade corrections to the 2^3P and 2^1P states and imprisonment corrections to the latter have yielded values for direct electron excitation cross sections to these states. The oscillator strength for the $2^1P \rightarrow 1^1S$ transition has been calculated. The 2^3S excitation function reported in the literature has been corrected for cascade using the 2^3P apparent cross section. Dissert. Abstr.

N69-18275 North Carolina Univ., Chapel Hill.
TENSOR AND SPINOR SPHERICAL HARMONICS FOR SU(3) ON THE 5-SPHERE
Margaret Amanda Bleick (Ph.D. Thesis) 1967 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-8659

Vector fields, second rank symmetric tensor fields and spinor fields which carry irreducible representations of SU(3) on the 5-sphere are investigated. In the vector and tensor cases these fields are required to be eigenvectors and eigentensors of the Laplace-Beltrami operator on the 5-sphere. The spinors are required to be eigenspinors of the Dirac operator. This is always possible because these operators commute with the action of SU(3) on the fields. Bases of vector, tensor and spinor fields are first constructed in a six dimensional Euclidean space and then projected onto the 5-sphere. It is necessary to form linear combinations of these bases in order to get eigenfunctions of the Laplace-Beltrami and Dirac operators. These linear combinations are calculated for some of the simpler representations. An ellipsoidal deformation of the 5-sphere is found to split the eigenvalues of the Laplace-Beltrami and Dirac operators in a way consistent with the Gell-Mann-Okubo mass formula. Dissert. Abstr.

N69-18280 Michigan State Univ., East Lansing.
HIGH RESOLUTION ABSORPTION, ZEEMAN AND MAGNETIC ROTATION SPECTRA OF THE FUNDAMENTAL AND SATELLITE BANDS OF NITRIC OXIDE IN THE NEAR INFRARED
Donald B. Keck (Ph.D. Thesis) 1967 260 p
Avail: Univ. Microfilms: HC $11.70/Microfilm $3.35 Order No. 68-7914

The absorption, Zeeman and magnetic rotation spectra of the 1-0 vibration-rotation bands of nitric oxide have been obtained using the Michigan State University high resolution (~ 0.07 cm^{-1} at ~ 2000 cm^{-1}) near infrared spectrometer. Improved values of the molecular constants have been obtained by a simultaneous least squares analysis of combination differences and frequencies. The spin-orbit constant was determined directly by means of the satellite band frequencies which were included. Theoretical calculations of the Zeeman patterns and intensities have been given. The observed spectra match these predictions very closely. A phenomenological theory of magnetic rotation spectra is outlined. Predictions made on the basis of this theory explain the major features of the observed magnetic rotation signals starting from rather basic principles. These features include the doublet structure of lines at high pressure and the intensity contour of the Σ-subband. Dissert. Abstr.

N69-17212*# General Dynamics Corp., San Diego, Calif.
EXPERIMENTS ON A HIGH POWER, PULSED, CONSTRICTED ARC HEATER
Rolf Dethlefsen Washington NASA Feb. 1969 53 p refs
(Contract NAS2-4665)
(NASA-CR-1246; GDC-DBE68-006) Avail: CFSTI CSCL 20I

Pulsed experiments on a high power constricted arc with axial flow were performed by discharging a lumped parameter transmission line composed of a number of capacitors and inductors. The arc current ranged from 1.8 to 3.6 KA with a flow rate of nitrogen from 5 to 40 g/sec. High speed photographs revealed flow instabilities. Under certain circumstances, the arc did not fill the tube; instead a relatively concentrated arc filament fluctuated about the tube. A swirling gas inlet was effective in reducing arc instabilities. Evidence for strong Maecker cathode jets was also found. Impinging on the constrictor walls, these jets could lead to increased erosion, or shorting of segments in a continuous facility. Cathode jets could be eliminated by using a cathode with simultaneous arc attachment on four parallel tungsten rods. This four-pin cathode also showed lower cathode erosion than a cathode with a single tungsten rod. In addition, a cascading circuit for gas breakdown triggering of the long tube was developed which is superior to wire explosion triggering. Author

N69-17217# Academy of Sciences (USSR), Moscow. Atomic Energy Inst.
STUDIES OF ELECTRON HEATING MECHANISM DURING ELECTRON BEAM INTERACTIONS WITH PLASMA
A. N. Karkhov 1968 20 p refs In RUSSIAN
(IAE-1830) Avail: CFSTI

Studies were made of conditions of electron heating and spectral oscillations excited in plasma by electron beams. Data obtained indicate that the circularly polarized electromagnetic waves propagating along the external magnetic field are responsible for electron heating. Author (NSA)

N69-17285# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
INVESTIGATION OF THE POSSIBILITY OF THE INJECTION OF A PLASMA INTO THE STELLARATOR "SIRIUS" THROUGH THE DIVERTER
V. G. Zykov and N. I. Rudnev 1968 12 p refs In RUSSIAN
(NP-17666) Avail: CFSTI

Experiments in the movement of a plasma, injected through the gap of the diverter, prepared for the stellarator "Sirius," are described. The injection was made from a coaxial source. With the help of a plasmascope, the distribution of the plasma within the chamber of the diverter during various intensities of the magnetic field (up to 20 ke(kiloelectrons)) was observed. The experiments showed that a significant part of the plasma is trapped by the magnetic flux, extracted through the gap of the diverter, and moves along the lines of force of the magnetic field. A part of the plasma is trapped by the magnetic flux, extracted through the gap of the diverter, and moves along the lines of force of the magnetic field. A part of the plasma which enters the ring region where the magnetic field is zero is distributed in the form of a complete tube in opposing directions along the longitudinal axis of the diverter near the diverter surface. Another part of the plasma intersects the chamber of the diverter across the magnetic field. With the help of the 8-mm interferometer, the density of the magnetic field, was determined. The

distribution of the density of the plasma, in accordance with the cross section of the chamber and the total of the trapped particles, was measured by a screened electric sonde.

N69-17326# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISTRIBUTION OF POTENTIAL OVER THE ARC OF A VORTEX-TYPE PLASMATRON
G. Yu Dautov et al 5 Feb. 1968 10 p. refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 5, 1965 p 132–135
(AD-679817; FTD-HT-23-1286-67) Avail: CFSTI CSCL 20/9

The voltage-current characteristics of a plasma arc of variable length a were investigated experimentally under stable-arc operation conditions. The arc was vortex-stabilized and the flow-turbulent. A special flow chamber was added to the generator to control the arc pressure independently of the arc length. Both the cathode and the anode were made of water-cooled copper, and the working gas was air. TAB

N69-17329# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EFFECT OF MAGNETIC CURVATURE ON DENSITY GRADIENT DRIFT INSTABILITIES
Kazuo Kitao Oct. 1968 14 p refs
(IPPJ-76) Avail: CFSTI

The effect of magnetic curvature on density gradient drift instabilities is examined for a collisionless plasma in which β satisfies $m/M < \beta < 1$, where β=plasma pressure/magnetic pressure, and m and M are the electron and ion masses. For simplicity, the effect of magnetic curvature is simulated by an equivalent gravitational field. The present considerations are restricted to the cases where the wavelength of perturbations is much longer than the mean ion Larmor radius and the radius of magnetic curvature is much larger than the characteristic length of the density gradient. It is found that the slow Alfven mode which is unstable in a straight and parallel magnetic field is stabilized by mangetic curvature with a sign favorable to stabilization of the interchange instability while it remains unstable by unfavorable curvature, and that the fast Alfven mode remains stable independently of the sign of magnetic curvature. Author

N69-17330# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RESONANCE PROBE CHARACTERISTIC IN A NONUNIFORM PLASMA
G. Lampis, S. Aihara, and K. Takayama Nov. 1968 28 p refs Supported in part by Japanese Soc. for the Promotion of Sci.
(IPPJ-77) Avail: CFSTI

The effect of a nonuniform density distribution in a plasma, on the transmission of rf power across it, is studied experimentally. It is found that the rf transmission characteristic presents double resonance, when the geometry of the transmission and the density distribution, within the plasma, allow the rf electric field to resonate in parallel with two different regions of plasma, having different densities. Author

N69-17369# Hamburg Univ. (West Germany). Institut fuer Angewandte Physik.
RADIAL AND AXIAL DEVELOPMENT OF LIGHT EMISSION IN A SPARK CHANNEL BY MEANS OF A STREAK CAMERA [DIE RADIALE UND AXIALE ENTWICKLUNG DES LEUCHTENS IM FUNKENKANAL, UNTERSUCHT MIT EINER WISCHKAMERA]
J. Koppitz Jul. 1968 28 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-33) Avail: CFSTI

The radial and axial development of the hot plasma spark channel is treated. The experiments were made with sparks generated in a homogeneous field under streamer conditions in hydrogen and nitrogen with a pressure of several hundred torr. The measured radial expansion is in good agreement with the theory of Braginskii, but not with that of Drabkina. A formula for the dependence of the channel radius on external paramtrs is derived. Axial inhomogeneities were found to be the consequence of an inhomogeneous development in the prediscbarge channel during the streamer stage. Author (NSA)

N69-17377# Sandia Corp., Albuquerque, N. Mex.
SURFACE IONIZATION OF ARGON OBSERVED IN PLASMAJET TESTS
K. L. Shipley May 1968 17 p refs
(Contract AT(29-1)-789)
(SC-RR-68-218) Avail: CFSTI

Spectral lines of ionized argon appear to be emitted from the surface of a tungsten body immersed in a supersonic argon plasma jet. The intensity of this spectrum and the temperature derived from a Boltzmann plot are unusually high. Author (NSA)

N69-17378# United Kingdom Atomic Energy Authority, Culham (England). Translations Office.
REACTION NEUTRONS AS A TOOL IN PLASMA DIAGNOSTICS
G. Lehner and F. Pohl 1967 28 p refs Transl. into ENGLISH from Z. Phys. (Ger.), no. 207, 1967 p 83–104
(NP-TR-1671; CTO-485) Avail: CFSTI; UK

The neutrons from d-d reactions in a hot deuterium plasma can be used for plasma diagnostic purposes. The ion velocity distribution is responsible both for the total rate of neutron production and the energy spectrum of the neutrons. Anisotropic velocity distributions give rise to neutron fluxes and neutron energy spectra which are also anisotropic. These effects are discussed for generalized Maxwellian distributions (characterized by different parallel and perpendicular "temperatures") and for monoenergetic distributions (three and two dimensional), which serve as typical examples. Author (NSA)

N69-17478# Princeton Univ., N. J. Plasma Physics Lab.
STABILITY OF OSCILLATIONS OF TRAPPED PARTICLES WHEN PLASMA QUASINEUTRALITY IS DISTURBED
V. G. Rukhlin et al Oct. 1968 35 p. refs In ENGLISH and RUSSIAN Transl. into ENGLISH from Akad. Nauk SSSR, Moscow, Preprint No. 105, 1968
(Contract AT(30-1)-1238)
(MATT-TRANS-67) Avail: CFSTI

The effect of stabilizing an instability in trapped particles by an electric field arising on departure of the plasma from quasi neutrality is studied in the example of a direct double (helial magnetic field with helical symmetry. It is demonstrated that electric fields arising in real installations as a result of withdrawal of ions to the chamber walls stabilize the known flute instability in trapped particles if the electric drift velocity v_{E_0} becomes comparable to or greater than $\sqrt{T_i}\, 2\pi r/L_{wind}$ (r is the plasma radius and L_{wind} is the spacing of the current winding). Lower-frequency disturbances with frequencies below the magnetic drift frequency are stabilized by smaller electric fields. In addition, a new instability has been found arising from the centrifugal drift of trapped particles in an electric field analogous to the known gravitational instability. This instability appears for exactly those electric fields for which stabilization of flute disturbances in trapped particles occurs; therefore, it is the most dangerous instability in plasma with an uncompensated charge. Author (NSA)

N69-17511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TOWARDS A THEORY OF THE NONLINEAR INTERACTION OF WAVES IN A PLASMA
L. M. Kovrizhnykh 17 May 1968 59 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Fiz. Inst. (USSR), v. 32, 1966 p 173–205
(AD-679686; FTD-MT-24-85-68) Avail: CFSTI CSCL 20/9

A complete quantum mechanical development of phenomena of nonlinear interactions of waves in a plasma is given. After a presentation of fundamental equations of a definitive nature there follows a treatment of (1) probabilities of processes of second order; (2) probabilities of scattering processes; (3) scattering cross sections; (4) probabilities of disintegration processes; and (5) a study of certain special cases including the interaction of transverse waves and the interaction of longitudinal Langmuir waves in a plasma. Author (TAB)

N69-17512# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE CYLINDRICAL WAVES IN RAREFIED PLASMA
Yu. A. Berezin et al 27 May 1968 23 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 1, 1967 p 116–124
(AD-679537; FTD-MT-24-76-68) Avail: CFSTI CSCL 20/9

The propagation of strong cylindrical waves in cold plasma is studied theoretically and the results are compared with an experiment. The propagation of the wave is considered for regimes where dissipative effects are sufficiently strong, so that nonlinear effects arise over distances much smaller than that of the radius of plasma under study. The current sheet driving the magnetic perturbance is described as exponential or sinusoidal in time. The experimental results on the properties of the wave were obtained by means of magnetic probes at various radii in the plasma column. The comparison of the experimental results with the computer output is limited since the latter assumes a constant dissipation factor. However the qualitative agreement is good. Author (TAB)

N69-17517 Michigan State Univ., East Lansing.
THE INTERACTION OF ELECTROMAGNETIC RADIATION WITH A BOUNDED PLASMA
Andrew Rostyslaw Melnyk (Ph. D. Thesis) 1967 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-7924

The interaction between electromagnetic waves and a bounded plasma is studied by extending the Fresnel equations of reflection and transmission to include plasma waves with irrotational electric fields. The properties of the plasma are incorporated in the dispersion relations for propagating waves. These dispersion relations are obtained from a frequency and complex wave vector dependent dielectric tensor $\epsilon(k,\omega)$ calculated from a linearized Boltzmann transport equation. Results show structure in the absorptance, reflectance, and transmittance spectrum of thin plasma slabs ($d<2\pi c/\omega_p$) due to resonance phenomena at frequencies where $kd = n\pi$; ($n = 1, 3, 5, \ldots$). These results suggest that the dispersion relations of metallic plasmas such as silver films may be optically measured. Dissert. Abstr.

N69-17527# Princeton Univ., N. J.
FLUTE INSTABILITY OF A CURVILINEAR PLASMA COLUMN WITH A CURRENT
V. D. Shafranov Apr. 1968 45 p refs Transl. into ENGLISH from Russian
(Contract AT(30-1)-1238)
(MATT-Trans-54; IAE-1351) Avail: CFSTI

A generalization of the Suydam criterion is obtained for an arbitrary curved plasma column. As a special case of the criterion, the known results of Mercier on local stability of a plasma in the vicinity of a magnetic axis are discussed. In a curved plasma column, along with the stabilizing effect of the shear of the magnetic lines of force, the stabilizing role of the magnetic well becomes significant. The occurrence of a magnetic well is caused by shifting of the magnetic axis into the region of a weak toroidal magnetic field. The part of the shift which is related to the balloon effect of the plasma column as a whole contributes to the magnetic well, in particular, compensating for the balloon mode of instability. The other part of the shift caused by electrodynamic stretching of the current column creates a vacuum magnetic well which does not depend on the plasma pressure. Author (NSA)

N69-17570# Plasma Sciences Labs., Inc., Van Nuys, Calif.
DEVELOPMENT OF DIAGNOSTIC METHODS FOR SEEDED AIR AND NITROGEN PLASMAS Final Report, 15 Jun. 1967–15 Jun. 1968
H. N. Olsen, G. Bedjai, F. L. Kelly et al Arnold AF Sta., Tenn. Arnold Eng. Develop. Center Dec. 1968 84 p refs
(Contract F40600-67-C-0017)
(AD-679530; AEDC-TR-68-217) Avail: CFSTI CSCL 20/9

Absolute emission coefficients of nitrogen atomic lines, of a wavelength increment of the $N2(+)(1-)(0, 0)$ band system, of the electron continuum and of several atomic lines of the seed material were measured in atmospheric pressure nitrogen and air plasma jets seeded with K_2CO_3 powder. Radial temperature distributions determined from measured emission coefficients were compared as the mean temperature of the plasma was reduced from 6000K to 3000K. In the lower range, which is most characteristic of the seeded air accelerator, temperatures determined from both absolute and relative intensities of atomic lines of the seed material agree well with those obtained from the electron continuum. The best species of radiation for temperature measurements in the range of 2500K to 4000K was, as the result of the investigation, selected to be the continuous radiation emitted by the seed material itself. Errors in temperatures determined from the measured continuum and resulting from averaged variations in seed concentration and its uniformity of distribution are shown to be less than 5% in the lower temperature range. Author (TAB)

N69-17577# Atomic Energy of Canada, Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
INTENSE PULSED SOURCES OF IONS AND ELECTRONS PRODUCED BY LASERS
G. Bourrabier et al Feb. 1968 21 p refs Transl. into ENGLISH from French Rapt. No. CEA-R-3109
(AECL-3031; CEA-R-3109) Avail: CFSTI

It is possible to obtain a very dense pulsed plasma by focusing a laser beam on a metal target. This report describes a device to accelerate the plasma burst and then extract the ions and electrons from the plasma. A study of the effect of the target material on the collected current shows the initial ionization potential of the target to be an important factor. Author

N69-17613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF ARC-PLASMATRON STUDY
I. V. Varlamov 16 Feb. 1968 12 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. Akad. Nauk Belorussk. SSR (Minsk), v. 7, no. 6, 1964 p 16–19
(AD-679663; FTD-HT-23-1361-67) Avail: CFSTI CSCL 20/9

The article deals with an approximation method of computing plasma temperature in the channel of an arc plasmatron. Comparisons are made of the results of the computation for some systems of working with experimental data in accordance with the

losses in the channel and direct measurements of the temperature by the spectral method. There are presented the results of experimental study of the distribution of the current in the channel of the plasmatron. Author (TAB)

N69-17641# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROTARY MOTION OF REGIONS NEAR THE ELECTRODE AND THE CHARACTERISTICS OF THE POSITION OF AN ARC COLUMN IN A PLASMATRON WITH GAS VORTEX STABILIZATION
L. I. Kolinina et al 16 Feb. 1968 13 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 3, 1965 p 80–84
(AD-679726; FTD-HT-23-1293-67) Avail: CFSTI CSCL 20/9

The motion and distribution of an arc column in a vortex stabilized arc jet at constant current were investigated experimentally by means of high speed cameras. Motion pictures were taken 10-15 sec after striking the arc at a speed of 5000 and 125,000 frames per second through a transparent window. The photographs of the arc resemble a comma with the bulge towards the gas flow direction. These results show that in the pressure range 2-8 bar there is a jerky motion of the arc spot near the inside electrode with the radial part of the column on the electrode wall. Furthermore, the diameter of the arc near the axis is much larger than the diameter of the arc in the radial direction. This difference is explained by means of the peculiar distribution of the column in the exit electrode. The rotation rate of the arc was found to be quite steady, with a maximum deviation of 20%. From the brightness magnitude of the arc spot diameter the current density in the arc spot diameter, as well as the specific energy flow, were estimated. Author (TAB)

N69-17683# Aerospace Corp., El Segundo, Calif. Lab Operations.
A PROGRAM FOR COMPUTING TRANSMISSION OF PLANE ELECTROMAGNETIC WAVES THROUGH AN INHOMOGENEOUS PLASMA SLAB, FEBRUARY–MARCH 1968
David C. Pridmore-Brown Jul. 1968 21 p refs
(Contract F04701-68-C-0200)
(AD-679778; TR-0200(9220-02)-3; SAMSO-TR-68-430) Avail: CFSTI CSCL 17/2.1

A computer program for calculating plane wave transmission through an inhomogeneous cold plasma slab is described. The program accepts arbitrary profiles (including jumps) in number density and collision frequency. It prints out the electric and magnetic field profiles for the angles of incidence, direction of incidence, and polarizations of the wave that are called for. It also gives the reflection and transmission coefficients in each case. Author (TAB)

N69-17784# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISTRIBUTION OF ELECTRIC FIELD STRENGTH OVER THE LENGTH OF A LONGITUDINALLY VENTILATED ARC IN A dc PLASMATRON
A. S. Vasilkovskaya et al 1968 18 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 1, 1967 p 166–171
(AD-679790; FTD-MT-24-113-68) Avail: CFSTI CSCL 20/9

The article presents, interprets, and evaluates the results of an experimental study of the distribution of electric field strength in an arc ventilated by longitudinal-turbulent air and created in a direct current plasmatron. Quartz-enclosed tungsten wire probes were inserted at distances of 40 mm along the length of the arc and were connected to a cathode ray oscillograph. The family of U-shaped curves (E, l) obtained by the authors of the present work and by others using different methods is offered as testimony of a certain regularity in the process. The experiment pointed up numerous deficiencies entailed by using a gas flow to keep the arc from touching the walls of the generator. Author (TAB)

N69-17819*# Avco-Everett Research Lab., Everett, Mass.
AN ION RESONANCE INSTABILITY IN GROSSLY NON-NEUTRAL PLASMAS
R. H. Levy, J. D. Daugherty, and O. Buneman Jul. 1968 56 p refs
(Contracts NAS8-21392; AF 49(638)-1553; AT(30-1)-3863)
(NASA-CR-73951; RR-302; TID-24688) Avail: CFSTI CSCL 20I

The addition of a certain fraction of ions to an otherwise stable cloud of electrons can, in certain circumstances, result in an instability. The case of a low-density ($q = \omega^2_p/\omega^2_c << 1$) electron cloud, in which the electron motions can be described by $E + v_e \times B = 0$, is considered in detail. The condition for onset of the instability is that the unperturbed ion orbits (which characteristically traverse the entire electron cloud) should involve frequencies close to that of the diocotron wave that can propagate on the electron cloud. This condition is equivalent to having the ratio Zm_e/m_i of the order of unity and is independent of the ion density. When instability is present, the growth rate of the order of the ion plasma frequency. Author (NSA)

N69-17854# Princeton Univ., N. J. Plasma Physics Lab.
CALCULATION OF BOHM AND CLASSICAL DIFFUSION IN THE SPHERATOR SP-1
S. von Goeler, U. Christensen, and H. Fishman Sep. 1968 21 p refs
(Contract AT(30-1)-1238)
(MATT-607) Avail: CFSTI

The particle flux through a magnetic surface has been computed for different configurations of the Princeton Spherator SP-1 for both classical and Bohm diffusion. The corresponding eigenvalue problem has been solved for Bohm diffusion. Author (NSA)

N69-17859 Florida Univ., Gainesville.
PLASMA DIAGNOSTICS USING A LOADED WAVEGUIDE
Ralph Arden Kinney (Ph.D. Thesis) 1967 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-9480

This dissertation is concerned with propagation in a plasma-loaded waveguide. The plasma is assumed to be isotropic. The axial variation of the electron density is assumed to consist of a semi-infinite extent of uniform density connected to an air dielectric region by a transition, or boundary, zone wherein the plasma number density varies from zero to the uniform value. A study was made of methods of solving for the electromagnetic fields in such a waveguide. By using combinations of two exponentially varying electron-density profiles it was possible to approximate complicated electron variations in the transition zone. Bessel functions with complex order, typical of solutions in the transition zone, were presented graphically for use in such approximations. Dissert. Abstr.

N69-17905# Institut Franco-Allemand de Recherches, St. Louis (France).
THE SPECTRUM OF THE LASER INDUCED AIR BREAK THROUGH [DAS SPEKTRUM DES LASERINDUZIERTEN LUFTDURCHBRUCHS]
H. Mach and F. Roesseler 9 Aug. 1967 10 p refs In GERMAN
(ISL-N-14/67) Avail: CFSTI

Visible and ultraviolet spectra of laser induced air plasmoids are compared with normal arc discharges. Results show that both spectra contain almost identical lines composed mainly of atomic and ionized nitrogen. Transl. by A.B.

N69-17954 Michigan Univ., Ann Arbor.
EXPERIMENTAL INVESTIGATION OF THE LOW-VOLTAGE ARC IN NOBLE GASES
Robert John Martin (Ph.D. Thesis) 1967 197 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-7664

The low-voltage arc is a high current mode of the hot cathode discharge that occurs in the Torr range of pressure of the noble gases if there is ample electron emission from the cathode. Under optimum conditions the low voltage arc may exist with a discharge voltage considerably less than the first excitation potential of the gas. This investigation consisted predominantly of Langmuir probe measurements of the discharge in planar electrode geometry. Guardringed planar probes were utilized. The volt-ampere characteristic of the hot cathode discharge in the Torr range of gas pressure was investigated to further define the low voltage arc. The study of the steady-state characteristics of the low voltage arc was predominantly in neon, although characteristics were also obtained in xenon and argon. No low-voltage discharge modes were obtained in hydrogen. The measured peak plasma potentials were approximately 14, 6 and 4.5 volts for neon, argon and xenon, respectively, considerably lower than the first excitation level of the respective gases. Dissert. Abstr.

N69-18010*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
RADIATION FIELDS OF ENERGETIC ELECTRONS IN HELICAL ORBITS WITHIN A MAGNETOACTIVE PLASMA
K. Sakurai and T. Ogawa Aug. 1968 21 p refs
(NASA-TM-X-63444; X-615-68-459) Avail: CFSTI CSCL 20I

The radiation fields produced by an energetic electron which is moving in helical orbit in the magnetoactive plasma are derived by solving the Maxwell's equations exactly. Those fields consist of three components which are characterized by different wave frequencies related to the anisotropic nature of the medium. The result, obtained in this paper, seems to be useful in investigating the suppression of the low frequencies of solar radio type 4 bursts and galactic radio emission, and suggests that the explanation for the influence of ambient plasmas on the gyro-synchrotron radiation from energetic electrons must be modified. Author

N69-18038 California Univ., Los Angeles.
ECHO PHENOMENA IN A HIGHLY IONIZED PLASMA
O'Dean Paul Judd (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-8775

The results of a theoretical and experimental investigation of cyclotron echo phenomena in a highly ionized plasma are presented. The published theory to date of two pulse cyclotron echoes in a plasma is modified to provide a general formulation for the case of Coulomb collisions, and extended to point out the possibility of echo generation by a single pulse excitation. The possible oscillator distributions produced by plasma effects alone are enumerated. The collective and Doppler effects in the plasma are shown to produce echoes even though the magnetic field is perfectly uniform. The effects of particle diffusion in the plasma are investigated. Experimentally it was observed that the echo could be excited by the conventional two pulse technique or by excitation with a single pulse of long duration. Dissert. Abstr.

N69-18039 Detroit Univ., Mich.
DEVELOPMENT AND APPLICATION OF THE THETA-PINCH FLASH LAMP
Eric Ernest Daby (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-8448

A theta-pinch plasma device has been modified for application as a source in chemical flash photolytic applications. The intensity and duration of optical emission have been investigated as functions of the circuit inductance, capacitance, discharge voltage, spark gap design, coil geometry, gas composition, gas pressure, and lamp geometry. Flash intensities greater than 10^{22} quanta cm^{-2} sec^{-1} have been attained at flash lifetimes of less than 10 microseconds. Conditions which minimize duration and maximize intensity of the flash have been determined and applied to construction of a source for the vacuum ultraviolet flash photolysis of acetaldehyde. The photolysis of acetaldehyde at wavelengths less than 2000 Å leading to dissociation into carbon monoxide, methyl radicals, and hydrogen atoms, has been studied. Dissert. Abstr.

N69-18041*# Michigan Univ., Ann Arbor.
AN EXPERIMENTAL AND THEORETICAL ANALYSIS OF THE CONVECTED BALANCED ARC
Leland Malcolm Nicolai (Ph.D. Thesis) Washington NASA Feb. 1969 194 p refs
(Grant NGR-23-005-128)
(NASA-CR-1267) Avail: CFSTI CSCL 20I

The behavior of direct current electric arcs in cross-flow and transverse magnetic fields was studied by observing interaction and energy exchange processes between the arc, the velocity field, and the magnetic field. Experiments with high current arcs immersed in supersonic airstreams proved that with cone cylinder electrodes the arc always slanted with the anode spot upstream of the cathode spot. The peak temperature was located forward of the arc axis. Slant angle at constant Mach number increased slightly with increasing current. A theoretical continuum fluid model was formed based on the experimental observation that the convected balanced arc is impervious to free stream. Analysis of the arc core, based upon this model, showed that one dimensional equations gave a satisfactory approximation for the temperature distribution along the x axis; as the joule heating term coefficient decreased to its constant value, the calculated peak temperature shifted to a more forward position and finally distorted around the periphery of the front half of the arc. G.G.

N69-18119 Pittsburgh Univ., Pa.
RECOMBINATION, ATTACHMENT AND DIFFUSION STUDIES IN NITRIC OXIDE AND CARBON DIOXIDE
Charles Stagg Weller, Jr. (Ph.D. Thesis) 1967 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-7849

Photoionized plasma-afterglows of NO have been studied by combined microwave and mass spectrometric techniques. Nitric oxide-neon mixtures are contained in a 10 cm resonant cavity where they are ionized by a single-pulse of Lymen α radiation. A temporal spectrum of ions diffusing to the wall is obtained by a differentially pumped mass spectrometer and multichannel analyzer. Analysis of the electron density decay curves obtained by microwave techniques to obtain an electron-ion recombination coefficient for NO^+ is complicated by the conversion of NO^+ to the dimer ion, $(NO)_2^+$. At sufficiently low densities of nitric oxide the $(NO)_2^+$ concentration becomes negligible, and the NO^+ wall current follows the electron density decay. From comparisons of experimental electron density decay curves with computer solutions of the electron continuity equation values are obtained. Electron-ion recombination in CO_2 has been studied using a slightly modified form of the apparatus. Dissert. Abstr.

N69-18151# European Space Research Inst., Frascati (Italy).
THE STABILITY OF PLANE PLASMAS
K. Schindler ed. Paris Jul. 1968 47 p refs Proc. of the ESRIN Study Group, Frascati (Italy), 4–8 Dec. 1967
(ESRO-SP-36) Avail: CFSTI

Stability and dynamical effects of neutral sheets, stability of plane neutral sheet for oblique propagation as well as imaginal stability arguments are discussed. Energy principles and the external region of the tearing mode as well as a model for the earth's magnetic tail are also described. ESRO

N69-18154# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPUTATION OF THE BOUNDARY-LAYER FLOW ON THE ELECTRICALLY CONDUCTIVE WALL OF A FLAT CHANNEL
V. M. Paskonov et al 16 Feb. 1968 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 3, 1966 p 12–19
(AD-679661; FTD-HT-23-1296-67) Avail: CFSTI CSCL 20/9

Magnetohydrodynamic boundary-layer-flow equations, based on the numerical calculation methods used for the boundary layer of a nonconducting fluid, are analyzed by separating the problems of a flow inside the flow center and of a flow within the boundary layer. The problem of finding the characteristics inside a flowing gas center is reduced to the solution of a differential equation with the boundary conditions for subsonic- and supersonic-flow speeds. For both, the numerical evaluations of flow characteristics were used for solving the equations of the boundary layer. Author (TAB)

N69-18156# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ASYMPTOTIC METHOD AND NONLINEAR BEHAVIORS OF WAVES IN PLASMA
Yukio Midzuno and Tsuguhiro Watanabe Nov. 1968 27 p refs
(IPPJ-78) Avail: CFSTI

Nonlinear behaviors of monochromatic traveling waves are studied by the use of the asymptotic method of Bogoliubov and Mitropolsky. The wave is assumed to be stationary in the first approximation, and nonlinear interactions are taken into account only for the wave and its harmonics under consideration. It is shown that two cases should be distinguished according to the frequency of the wave in the first approximation, as given by a simple root or a double root of the dispersion relation. The dominant corrections to the frequency and the growth rate due to nonlinearity are of the second order with respect to the amplitude in the former case, but is of the first order in the latter case. Characteristic behaviors of the wave in the latter case are studied by discussing a model equation and a special case of two beam instability. Author

N69-18189*# California Univ., Los Angeles. Plasma Physics Group.
DRIFT WAVES IN THE LINEAR REGIME
R. E. Rowberg and A. Y. Wong Feb. 1969 57 p refs
(Grant NGR-05-007-066)
(NASA-CR-99339; R-39) Avail: CFSTI CSCL 20I

A method of external excitation of density gradient drift waves in a stable, collision dominated plasma is presented whereby the linear theory of drift waves is verified. The procedure permits limitation of the perturbation amplitude. The driven oscillations are coherent, nearly sinusoidal modes on which measurements of the plasma parameters are made. The linear dispersion relation derived from the fluid equations is verified demonstrating the strong stabilizing effect of transverse diffusion resulting from ion viscosity. An additional damping process resulting from ion loss at the cathodes is introduced whereby complete stabilization of the plasma to drift waves is possible. The dependence of the growth rate on the phase angle between the density and potential perturbation is shown in the regime where viscous damping is not dominant. Verification of the dependence of the axial wavelength on the sheath conditions at the plasma cathode boundary and on the length of the plasma column is demonstrated. Author

N69-18216# Sandia Corp., Albuquerque, N. Mex.
CALCULATION METHOD OF THE DISPERSION RELATION OF A COLLISIONAL PLASMA [METHODE DE CALCUL DE LA RELATION DE DISPERSION D' UN PLASMA COLLISIONNEL]
Charles Lafleur 3 Oct. 1968 9 p refs Transl. into ENGLISH from French Rept. CEA-R-3413 Sponsored by AEC
(SC-T-68-1542; CEA-R-3413) Avail: CFSTI

Starting from kinetic equations derived from the Fokker–Planck term introduced by Chandrasekhar, the dispersion relation of a homogeneous plasma is obtained easily through the use of a convenient set of eigenvalue functions. Author (NSA)

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Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-17223# Atomic Energy Commission Research Establishment, Riso (Denmark).
COMPUTER SIMULATION OF THE PLASTIC DEFORMATION IN FACE-CENTERED CUBIC POLYCRYSTALS AND THE ROLLING TEXTURE DERIVED
T. Leffers Jul. 1968 33 p refs
(RISO-184) Avail: CFSTI

The fcc rolling texture developed by $\{111\}\langle 110\rangle$ slip is calculated by computer simulation of the plastic deformation. The computer program permits the use of different models for the deformation. In one extreme model the grains are assumed to deform like isolated single crystals. The other extreme is a model fulfilling Taylor's requirement that the deformation of the individual grains should correspond to the macroscopic deformation. The model in which the grains are considered to be isolated single crystals leads to a calculated texture of the brass type. A calculated copper-type texture is developed when the Taylor condition in which the microscopic and macroscopic deformation is correspond. is partly fulfilled. Thus, both types of rolling texture found experimentally may be developed by $\{111\}\langle 110\rangle$ slip. A dislocation model for the deformation during rolling for fcc polycrystals is proposed. The transition from brass-type to copper-type texture is ascribed to the pile-ups of screw dislocations being dispersed by cross-slip. Author (NSA)

N69-17286 Minnesota Univ., Minneapolis.
THEORETICAL MAGNETIZATION DISTRIBUTIONS IN FERROMAGNETIC SPHERES
Charles Henri Stapper, Jr. (Ph.D. Thesis) 1967 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-7388

The calculation of magnetic domains in ferromagnets is attempted. The theory is based on the principle of least energy. Mathematical expressions for the exchange, anisotropy and magnetostatic energies are minimized. The resulting equilibrium conditions (Brown's equations) are solved. This is done by means

of a digital computer. The computations are made for spherical particles. Calculations are made possible by assuming a constraint on the magnetization. The magnetic moment vectors are assumed to rotate in a plane. Their angle of rotation varies only in a direction perpendicular to that plane. The solutions consequently consist of domains separated by Bloch walls. The results demonstrate that domains exist as equilibrium solutions. The magnetization in each domain, however, is not constant. This dispels the widely held notion that domains are uniformly magnetized regions. Dissert. Abstr.

N69-17373# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECTIVE CROSS SECTIONS OF THE FORMATION OF DEFECTS IN GAAS UNDER THE EFFECT OF GAMMA-RAYS
M. A. Krivov et al 18 Apr. 1968 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniik, Fiz. (Tomsk), no. 4, 1964 p 147–151
(AD-679512; FTD-HT-23-250-68) Avail: CFSTI CSCL 20/12

The work calculates the theoretical values of the effective cross sections of defect formation for Ga and As in GaAs under the effect of gamma-rays. Certain experimental results are introduced for the effective cross sections in p-GaAs for the fine level 0.05 eV from the top of the valence band. Author (TAB)

N69-17382 Michigan Univ., Ann Arbor.
STUDIES OF THE ACOUSTOELECTRIC EFFECT, ULTRASONIC ATTENUATION AND TRAPPING IN CADMIUM SULFIDE
Victor Eugene Henrich (Ph.D. Thesis) 1967 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-7622

This is a study of ultrasonic attenuation and electron trapping in cadmium sulfide single crystals by means of the acoustoelectric effect. CdS is strongly piezoelectric, giving rise to a large phonon-electron coupling. Conduction electrons can be generated by illumination, resulting in acousto-electric signals of sufficient magnitude to be analyzed in great detail. Studied were the acoustoelectric current waveforms generated when a burst of 30 MHz ultrasound short compared to the sample travels through it. In a uniform crystal, the current should be proportional only to the acoustic energy density in the crystal and hence should decay exponentially with time. The decay time is a measure of the total ultrasonic attenuation. This method was used to measure ultrasonic attenuation as a function of conductivity in five CdS samples. By varying the conductivity, it has been possible to determine the electronic and lattice parts of the attenuation separately. The method is independent of bond losses, and transducer efficiencies, and there is no limit to how large an attenuation can be measured. Dissert. Abstr.

N69-17429 Arizona Univ., Tucson.
IDENTIFICATION CREEP IN CRYSTALS AT LOW HOMOLOGOUS TEMPERATURES
Walter Wyrick Walker (Ph.D. Thesis) 1968 358 p
Avail: Univ. Microfilms: HC $16.20/Microfilm $4.60 Order No. 68-8303

The phenomenon of indentation creep in ionic crystals under loads in the range from 25 to 500 grams has been investigated. The load range used was sufficiently high to result in indentations having a depth greater than three microns. Other investigators have studied this phenomenon using a lower-load range with correspondingly shallower indentations. In the lower-load range, indentation creep in ionic crystals has been interpreted variously as being due to the effect of adsorbed water, charged complex ions, or highly polar solvents on the movement of near-surface dislocations. It was found in the present investigation that indentation creep is not limited to shallow indentation depths, but that it occurs much deeper than three microns, which results from the use of higher indenting loads. Indentation creep did not exhibit the anomalous response to temperature low-load range. The major factor influencing indentation creep in the higher-load range was the magnitude and polarity of the electrical charge on the particular dislocations involved in the creep process. Dissert. Abstr.

N69-17432# General Dynamics/Pomona, Calif.
ORGANIC SEMICONDUCTOR JUNCTIONS Final Report, Feb. 1965–Feb. 1968
Esther Krikorian Jun. 1968 283 p refs
(Contract AF 19(628)-4363)
(AD-679601; AFCRL-68-0384) Avail: CSFTI CSCL 20/12

Three phases of work are discussed: (1) Screening of a large number of organic systems relative to conductivity and carrier type. Selection criteria were low resistivity (less than 10,000 ohm-cm) and amenability to changing of majority carrier type by additive control (doping); (2) Detailed study of additive effects on selected organic semiconductor hosts; (3) Formation of organic p-n junctions - the final objective of this work. The screening phase led to selection of charge transfer complex systems as principal materials of study in phases (2) and (3). Specifically, tetrathiothetracene-orthochloranil, perylene-bromine, magnesium-phthalocyanine and tetracyanoquinodimethane salt systems were studied with various metal and organic additives as dopants. Limited studies were also performed with polymers. Materials with resistivities as low as 0.1 ohm-cm were prepared. Additive control produced large variations of n- and p-type characteristics in a single host system. Results of p-n junction diodes by thermal diffusion of additives. Rectification ratios of up to 200 were achieved. Author (TAB)

N69-17443 Ohio State Univ., Columbus.
SERIES ASSIGNMENTS IN THE FLUORESCENCE LINE SPECTRA OF HIGH PURITY CADMIUM SULFIDE
Lawrence Conde Greene (Ph.D. Thesis) 1967 78 p
Avail: Univ. Microfilm: HC $4.20/Microfilm $3.00 Order No. 68-8827

A furnace was designed and fabricated in which single crystal platelets of cadmium sulfide could be grown under carefully controlled conditions of temperature and carrier gas composition. The single crystal platelets obtained from this furnace were used in an exploratory study of the relationship between the low temperature (4.2°K) emission line spectra of high purity cadmium sulfide and the native defect structure. The line spectrum, excluding free exciton lines, was separated into groups of co-occurring lines. This separation was made empirically by observing the lines which always appeared together. Seven such groups or series were found. Six of these series showed line separations suggestive of longitudinal optical phonon assistance. Tentative defect assignments were made for the various series by observing the changes in relative intensity of the lines as the carrier gas composition was changed in steps from oxidizing to reducing. Dissert. Abstr.

N69-17446# Los Alamos Scientific Lab., N. Mex.
DEVIATIONS OF SURFACE IMPEDANCE OF IDEAL SURFACES IN WEAK FIELDS
J. Halbritter [1968] 12 p refs Transl. into ENGLISH from Kernforschungszentrum Rept. KFK-3/68-1
(LA-tr-68-56; KFK-3/68-1) Avail: CFSTI

Surface impedance in superconducting state and for weak RF fields, i.e., $H << H_{CRIT}$, can be calculated and the results

agree quite well with experiments. An equally successful theory for fields close to H_{CRIT} and nonideal surfaces is missing. A discussion of presented of models which can be used to understand qualitatively the measured results and to allow predictions for important applications (accelerator cavities). First, critical RF magnetic fields are discussed. It can be deduced from the results of J. P. Turneaure and from other experiments on phase transitions that for real surfaces and long-lasting RF excitation, the amplitude has to be smaller than the critical magnetic field. A realistic limit for the field level depends on the increase of the surface resistance with amplitude. This increase for amplitudes close to the critical field but for ideal surfaces has been estimated to be less than a factor of 5. The measurements, too, have not yet indicated larger factors. For nonideal surfaces, one has first of all to understand the measured aging effect of lead surfaces and the high residual resistance. It is shown that microroughness may be an explanation. Author (NSA)

N69-17451# Bettis Atomic Power Lab., West Mifflin, Pa.
INVESTIGATION OF THE ACTIVE CRYSTAL LENGTH IN THE PLASTIC RANGE OF NEUTRON-IRRADIATED COPPER SINGLE CRYSTALS. 1: THE FORMATION OF SLIP BANDS
H. Neuhauser (Ph.D. Thesis—Munich Univ., 1967) [1968] 32 p refs Transl. into ENGLISH from Phys. Stat. Sol. (Ger.), v. 25, 1968 p 593–608 Supported in part by Ger. Res. Assoc.
(WAPD-Trans-0093) Avail: CFSTI

Electron microscopic and cinematographic studies show that the slip bands within the Lüders band of a neutron-irradiated copper single crystal consist of several slip lamellae, which form one after another in the course of slip band formation. The strain within these lamellae develops to a good approximation homogeneously, and is accomplished in a rather short time (e.g., $\approx 10^{-1}$ sec at room temperature with a crosshead speed of 10^{-3} mm/sec). The structure and development of the slip bands as a function of crosshead speed, temperature, and neutron dose are explained qualitatively as due to the concurrence of the cutting process and cross slip of the gliding dislocation. Author (NSA)

N69-17475# Pennsylvania Univ., Philadelphia. Dept. of Physics.
THE DIELECTRIC PROPERTIES OF THE CUBIC IV–VI COMPOUND SEMICONDUCTORS
M. H. Brodsky, E. Burstein, and S. Perkowitz 1968 22 p refs
(Contract Nonr-551(51))
(AD-679586; TR-21) Avail: CFSTI CSCL 20/12

The dielectric and infrared (lattice dynamic) properties of the cubic IV-VI compound semiconductors are reviewed. The values of macroscopic dynamic ionic charge are found to be appreciably larger than the corresponding values for alkali halide and zincblende type crystals. The large values of e(T)*, which arise from the redistribution of electronic charge, provide further indication that the atomic dipole Lorentz field is the destabilizing factor responsible for the low values of omega(T) in the IV-VI compounds. Author (TAB)

N69-17498# IIT Research Inst., Chicago, Ill.
RESEARCH ON ELECTRICAL CONDUCTIVITY AND CONDUCTION MECHANISMS IN ALUMINA Final Report, 1 Jul. 1966–30 Jun. 1968
John J. Mills Wright-Patterson AFB, Ohio ARC Aug. 1968 51 p refs
(Contract AF 33(615)-5448)
(AD-680005; ARL-68-0154) Avail: CFSTI CSCL 20/12

A research study to better understand conduction mechanisms in alumina was conducted. Defect equilibration studies were performed on single crystals in which specimens were heated to elevated temperatures in controlled environments and then rapidly quenched. Defect structure changes were determined by ionic and electronic resistivity measurements. Author (TAB)

N69-17499# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION AND DEFORMATION DEFECTS IN CRYSTALS
Ye. V. Kolontsova 29 Mar. 1968 14 p refs Transl. into ENGLISH from Dokl. Soveshch. (Moscow), 1962 p 257–263
(AD-679534; FTD-HT-23-125-68) Avail: CFSTI CSCL 20/2

The effect of x-ray or neutron irradiation and of plastic deformation on the structure of ionic crystals (LiF, NaCl, KCl, AgCl) and of metal crystals (Al, Zn, Cd, Sn) has been investigated. It was found that both irradiation and deformation generate additional interference patterns which appear on the background of diffusion peaks. As the intensity of irradiation or deformation increases, the number of these patterns increases to such an extent that they form a single arched dash. Under the effect of irradiation or deformation, single crystals break into fragments and their orientation becomes disrupted. The extent of crystal fragmentation depends on the crystal structure and the intensity of irradiation or amount of deformation. The changes in LiF crystal structure induced by neutron irradiation and plastic deformation are identical, as proved by the increase in the appearance of diffusion peaks observed during neutron irradiation of diamond, silicon, molybdenum, and quartz single crystals and in the deformation of aluminum single crystals. Since the changes in crystal structure produced by irradiation and deformation are similar, the residual defects in crystals produced by deformation and irradiation are also similar. Author (TAB)

N69-17503# Argonne National Lab., Ill.
METHOD OF PRODUCING SUPERLOW TEMPERATURES BY DILUTING He 3 IN He 4 [OPOLUCHENII SVERKHNIZKIKH TEMPERATUR PUTEM RASTVORENIYA He 3 V He 4]
B. S. Neganov Oct. 1968 33 p refs Transl. into ENGLISH from Russian Rept. JINR-P13-4014 Sponsored by AEC
(ANL-Trans-681; JINR-P13-4014) Avail: CFSTI

A short description is presented of the principle of operation of refrigeration devices based on the use of latent heat in diluting liquid ^3He in ^4He and the quantitative analysis is made. In particular, the Joule–Thompson effect in a solution has been considered. It has been stated that, practically, the effect is a result of heating due to friction and the corresponding formulas for calculations have been given. It has been found that dilution specific heat capacity at constant osmotic pressure coincides with the specific heat capacity at a constant volume at any temperatures below 0.1 °K and taking this into account the refrigeration capacity of the system has been calculated and heat calculations of heat exchangers have been made for cooling the inverse flow ^3He in the continuous operating devices. A new type of continuously operating heat exchanger has been suggested and the advantage of its application for cooling the ^3He flow is discussed. The formula has been obtained for calculating the heat flow through heat bridges with the account of heat transfer due to He^3diffusion. Author (NSA)

N69-17510# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION GENERATION OF DISLOCATIONS IN ALKALI-HALIDE CRYSTALS
E. L. Andronikashvili et al 15 Mar. 1968 13 p refs Transl. into ENGLISH from Tr. Vses. Soveshch. Po Fiz. Shchelochnogaloidnykh Kristallov (Riga), 1962 p 284–286
(AD-679718; FTD-HT-23-114-68) Avail: CFSTI CSCL 20/2

Dislocations were investigated by the etching method. X-ray irradiations was performed on a RUP-200-20-4 stand (tube 3 BPM-200, 65 keV, 10 mA). Neutron irradiation was conducted in a IRT-2000 nuclear reactor. This series of tests showed that

throughout the investigated interval of x-ray exposure times (up to 10 h) the density of dislocations in KC1 crystals did not vary; photomicrographs of the same section of a KC1 crystal etched before and after irradiation were absolutely identical. As an example we introduced the photomicrographs for 8 h of irradiation. TAB

N69-17534# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THERMAL EFFECTS DURING THE REACTION OF RUBY LASER BEAM WITH "TRANSPARENT" CRYSTALS
V. M. Vatul'ov and A. M. Kamux 24 May 1968 9 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 12, no. 7, 1967 p 1200–1202
(AD-679791; FTD-HT-23-65-68) Avail: CFSTI CSCL 20/12

This is a continuation of earlier work where it was shown that when a crystal is damaged by a laser beam, its absorption spectrum contains no evidence of an appreciable local heating in particular sections of the crystal. Since the major changes in the absorption spectrum were attributed to both heating of the crystal as a whole and to the effect of the electric field, the authors used the same setup to measure the absorption spectrum under conditions when the influence of the electric field is eliminated, modifying the equipment to permit photography of the spectrum during the entire laser pulse. The crystals tested were CdS, ZnS, CdS-CdSe, and GaSe. In all cases a long-wave shift was observed in the absorption edge and in the interference patterns, owing to the multiple reflection or interference of the birefringence waves (when the crystal was placed between crossed Nicol prisms). The shift was observed when the spectrum was photographed at the end of the laser pulse. Although the temperature rise was not large (close to 10 degrees for CdS and ZnS and more for the other crystals), it is concluded that the changes in the spectrum are due to the thermal effects. TAB

N69-17573# Oxford Univ. (England). Engineering Lab.
FIELD AND PHOTON ENHANCED FIELD EMISSION FROM THIN FILM FIELD EMISSION DEVICES Scientific Interim Report
S. Adram-Husain and D. Walsh 25 Nov. 1968 3 p refs Reprinted
(Grant AF-EOAR-33-67)
(AD-679946; AFOSR-68-2659) Avail: CFSTI CSCL 20/12

Thin-film sandwich devices of CdS-SiO-metal have been made. They have current/voltage behaviour characteristics of field emission from semiconductors. With reverse bias, the current is very much smaller. The field-emission current is greatly enhanced by illuminating the device with 2.41 and 2.54 eV photons (from an argon-ion laser). Under pulsed laser excitation (pulse duration 1 microsecond) the enhanced emission persisted for more than 20ms. These experiments are analogous to some previous work on vacuum field emission. A possible mechanism for the enhanced emission is discussed. Author (TAB)

N69-17593# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
RESEARCH ON IMPROVED 2-6 CRYSTALS Final Technical Report, 8 Mar. 1965–7 May 1968
L. R. Shiozawa, J. M. Jost, and G. A. Sullivan Wright-Patterson AFB, Ohio ARL Aug. 1968 191 p refs
(Contract AF 33(615)-2708)
(AD-679566; ARL-68-0153) Avail: CFSTI CSCL 20/2

This research program has been directed toward improving the quality of vapor-grown CdS, CdSe, and ZnTe crystals from the standpoint of both foreign impurities and intrinsic structural defects. Measurable improvements in purity of the final crystals have been obtained by specific purification steps, consisting of a sintering procedure and one or more fractional vacuum sublimations, applied to available semiconductor-grade material. Crystal quality as related to intrinsic defects has been improved, both during crystal growth and treatment after growth, through a better understanding of phase equilibria and point-defect equilibria and their relationships. A computer program has been set up and specific calculations were made for ZnTe. Evidence from diffusion experiments and from the examination of the void-precipitation phenomenon in ZnTe has shown that Zn vacancies are the significant intrinsic point defects in this material. Evaluation of crystal quality has primarily been placed on microscopic observations and electrical measurements such as photoconductivity, thermally-stimulated current, and current oscillations. TAB

N69-17599# Sandia Corp., Albuquerque, N. Mex.
THE DETERMINATION OF THE ELEVATED TEMPERATURE SEEBECK COEFFICIENTS OF COMMON THERMOCOUPLE MATERIALS REFERENCED TO PLATINUM
R. M. White Oct. 1968 32 p
(SC-RR-68-538) Avail: CFSTI

The elevated temperature Seebeck coefficients of common thermocouple materials referenced to platinum are determined and presented in tabular form for both the Centigrade and Fahrenheit temperature scales. The data are also presented as a polynominal series, with appropriate polynomial coefficients determined. Author (NSA)

N69-17620# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INVESTIGATION OF THE REFLECTION OF HIGHLY ALLOYED GALLIUM ARSENIDE IN A WIDE SPECTRAL RANGE
M. B. Kagan et al 3 May 1968 10 p refs
Transl. into ENGLISH from Zh. Prikl. Spektroskopii (Minsk), v. 5, no. 6, 1966 p 770–773
(AD-679792; FTD-HT-23-1612-67) Avail: CFSTI CSCL 20/12

The optical properties of highly alloyed monocrystals and diffusion layers of p-type gallium arsenide are studied in the spectral range from 0.2 to 25 micrometers. Proposed and examined experimentally is the method of bleaching, the application of selective coatings, and the alteration of the microrelief of the surface with the aim of decreasing the reflection factor in the desired region of the spectrum. Author (TAB)

N69-17637 Clemson Coll., S.C.
HIGHER ORDER ISOTHERMAL ELASTIC CONSTANTS
Bobby Earl Powell (Ph.D. Thesis) 1967 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-9023

The theory of finite deformations can be used to analyze deviations from linearity in stress (σ)-relative extension (ϵ) curves of the form $\epsilon = s\,\sigma + \delta(s\sigma)^2$, where s is a second-order elastic constant and δ is a combination of second- and third-order elastic constants. Conversely, if such deviations are measured experimentally, the values of certain combinations of the third-order constants can be ascertained. The objectives of this project were to construct a sensitive tensile testing apparatus, to grow various whiskers and fibers, to study the mechanical properties of these samples, and to interpret any nonlinear results in terms of higher order elastic constants. The quartz fibers used in the experiments were formed in a flame by the method of Naher. All of the metal whiskers were grown by the hydrogen reduction of a halide of the metal. Dissert. Abstr.

N69-17640 Illinois Univ., Urbana.
THE EFFECT OF HIGH PRESSURE ON S AND Te-DOPED $GaAs_{1-x}P_x$
Magnus George Craford (Ph.D. Thesis) 1967 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-8042

The pressure dependence of the electrical resistivity of n-type $GaAs_{1-x}P_x$ is measured to a pressure of 7 kilobars at temperatures of 77°, 195°, and 300°K. The samples are doped with sulfur and tellurium and have carrier concentrations in the 10^{18} – 10^{19} cm^{-3} range. Changes in the resistivity as large as four orders of magnitude are observed at 77°K for samples in the composition range $0.30 \leq x \leq 0.40$. The behavior of the samples is consistent with a model in which the higher lying [100] conduction band edge has associated with it a donor level which is deep with respect to the [100] minima. The level depth with respect to these minima is found to be ≈ 0.03 eV for Te-doped crystals, and ≈ 0.06 eV for S-doped crystals. The S-doped samples also exhibit a light-sensitive, long-lifetime trapping behavior. The trapping appears to be associated with an additional deep level which moves away from the [000] conduction band minimum at the rate of approximately 10.8×10^{-3} eV/kbar. Dissert. Abstr.

N69-17661 Minnesota Univ., Duluth.
WORK FUNCTION STUDIES OF ALKALI-COVERED SEMICONDUCTORS
Roland Everette Weber (Ph.D. Thesis) 1967 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-7404

Work function and low-energy electron diffraction (LEED) measurements have been made on clean and alkali-covered Ge and Si surfaces. Aluminosilicate ion sources have been used to deposit accurately measurable quantities of Na, K, and Cs ions on surfaces normal to the Ge(111), Ge(100), Si(111) and Si(100) crystal directions. The resulting work function versus alkali coverage curves, when plotted on semi-log paper, consist of nearly-straight line segments with distinct breaks. The coverages at which the breaks occur are consistent with the clean surface structures determined for each surface by LEED observations. The LEED system has also been used to study the energy spectra of Auger electrons from these surfaces. It is shown that a surface impurity in a quantity as small as 0.1 monolayer can be detected and identified by this measurement. Dissert. Abstr.

N69-17662 Oklahoma State Univ., Stillwater.
PHOTOCONDUCTIVITY AND SURFACE EFFECTS IN Zn-DOPED POLYCRYSTALLINE STANNIC OXIDE
Herman Excell Matthews, Jr. (Ph.D. Thesis) 1967 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-8454

A study was made of the effect of ambient gas pressure on the electrical conductivity of polycrystalline Zn-doped stannic oxide in the temperature range −180° to +125°C. The primary objective was to obtain qualitative and/or quantitative descriptions of processes observed using information obtained from the following measurements: equilibrium dark currents, dark current decays, photocurrent decays, thermal quenching, and thermally stimulated currents. The component of the ambient gas important in affecting electrical properties was shown to be oxygen and although the exact species was not identified, arguments were made for it to be O^-_2. Changes in the equilibrium dark currents were explained in terms of small changes in the density of chemisorbed oxygen. Dissert. Abstr.

N69-17664# International Business Machines Corp., Hopewell Junction, N. Y. East Fishkill Lab.
MATHEMATICAL SIMULATION OF THE EFFECTS OF IONIZING RADIATION ON SEMICONDUCTORS
David P. Kennedy Aug. 1968 20 p refs
(Contract F19628-67-C-0116)
(AD-680001; IBM-TR-22-731; Scientific-2; AFCRL-68-0564) Avail: CFSTI CSCL 20/12

A method is shown whereby differential capacitance measurements can be used to establish the impurity atom distribution in a semiconductor. Unlike previously published information on this topic, the method presented here is applicable to the measurement of semiconductor material containing a significant electrostatic charge. Illustrations are given of the differential capacitance inferred impurity profiles in the vicinity of abrupt and linearly-graded high-low junctions. Author (TAB)

N69-17669# Wesleyan Univ., Middletown, Conn.
MOESSBAUER EFFECT IN THE STUDY OF SOLIDS Final Report
William L. Trousdale 15 Nov. 1968 5 p refs
(Grant AF-AFOSR-636-64)
(AD-679640; AFOSR-68-2764) Avail: CFSTI CSCL 20/12

The research project of which this is the final report had as its general objective the measurement of the properties of impurity atoms in solids as these properties are reflected in the nuclear magnetic field, the nuclear quadrupole electric field, the electronic density at the nucleus and the mean square velocity of the nucleus. These parameters are all measured using the Mossbauer effect. Author (TAB)

N69-17732# Systems Research Labs., Inc., Dayton, Ohio.
RELATIONS BETWEEN POINT DEFECTS IN THE COMPOUND M X_2
R. W. Vest, W. C. Tripp, N. M. Tallan, and H. C. Graham Wright-Patterson AFB, Ohio ARL Oct. 1968 76 p refs
(Contract AF 33(657)-10815)
(AD-680009; SRL-TR-580-E; ARL-68-0186) Avail: CFSTI CSCL 20/12

The results of a computer study of the mass action equations as used for the formation of point defects in binary compounds are presented. The results are in easily read tabular form which a neutrality condition can be deduced for a particular predominant defect. The pressure dependence and the equilibrium constants involved in the formation of each defect are listed. Author (TAB)

N69-17733# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Aero Propulsion Lab.
AN APPARATUS FOR THE IRRADIATION OF SUPERCONDUCTORS Technical Report, Jul. 1964–Jul. 1966
Charles E. Oberly Sep. 1968 129 p refs
(AD-680012; AFAPL-TR-67-168) Avail: CFSTI CSCL 20/3

The effects of high-energy particulate irradiation on the properties of superconductive materials are described. Special emphasis is placed on the nature of high-energy neutron-induced defects and their correlation with magnetic flux pinning in Type 2 superconductors. Possible difficulties in applying superconductive magnets to controlled thermonuclear reactors are suggested. The design, construction, and operation of an experimental apparatus are described in detail. The use of this apparatus for the detailed study of high-energy (14 mev) neutron irradiation on the technologically significant Type 2 superconductive materials is described. Long-duration neutron generation using a Cockroft-Walton accelerator is discussed. Design considerations for neutron irradiation cryostats are discussed in detail. Author (TAB)

N69-17735 Minnesota Univ., Minneapolis.
ION TRAPPING IN ROTATING SUPERFLUID LIQUID HELIUM UNDER PRESSURE
William Porter Pratt, Jr. (Ph.D. Thesis) 1967 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-7367

Measurements of the lifetime of negative ions trapped in rotating superfluid liquid helium have been made in the range 10 to 1000 seconds as a function of temperature and applied electric field at the saturated vapor pressure of the liquid. Measurements of the lifetime of trapped negative ions have also been made in the range 20 to 400 seconds as a function of temperature and pressure from the vaporization pressure to the solidification pressure of liquid helium. The experiment involves observing the amount of trapped charge released by the liquid upon cessation of rotation. A reproducible amount of charge is initially trapped in the liquid rotating at 6 rad sec $^{-1}$ and held in rotation for a variable waiting period before release. The decay in the amount of the trapped charge in the rotating liquid has been observed by this method to be exponential in time. Over the full range of pressures and temperatures covered in this experiment, no positive ion trapping was observed. Dissert. Abstr.

N69-17744# Eagle-Picher Co., Miami, Okla. Research Labs.
RESEARCH IN PURIFICATION AND SINGLE CRYSTAL GROWTH OF 2-4 COMPOUNDS Final Technical Report, 15 Apr. 1965-14 Apr. 1968
Richard H. Fahrig, George N. Webb, and Lloyd W. Brown Washington ARL May 1968 146 p refs
(Contract F33615-67-C-1575)
(AD-679636; ARL-68-0096) Avail: CFSTI CSCL 20/2

A process for the purification of cadmium metal by multiple treatment steps is described. Impurities in cadmium, as determined by emission spectrographic, mass spectrographic, and atomic absorption are given in tabular form. The preparation of various pure semiconductor materials of the Group II-VI compound type is discussed and tables of analytical data for each are included. The level of impurity concentration in synthesized cadmium sulfide was significantly lowered. Less than 1 part per million (atomic) total impurities was found by the mass spectrograph in two batches of CdS. The growth of crystals of pure II-VI compounds and mixtures of compounds from the melt is reported. Included are data concerning doping of melt grown crystals with various elemental dopants, and, in the case of some compound semiconductors, the maximum doping levels possible by this method. The results of vapor phase crystal growth of CdS and ZnS, are given. Preliminary experiments with hydrothermal and gel diffusion crystal growth are reported. Author (TAB)

N69-17763 Ohio State Univ., Columbus.
AN ELECTRON PARAMAGNETIC RESONANCE STUDY OF DOUBLY IONIZED MANGANESE IN BERYLLIUM BASIC ACETATE SINGLE CRYSTALS
Louis Roy Lowery, Jr. (Ph.D. Thesis) 1967 73 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-8851

An electron paramagnetic rotation study was performed upon a crystal of beryllium basic acetate in which a small number (less than one per cent) of the beryllium atoms were replaced by manganese atoms. The beryllium sites were found to exhibit trigonal symmetry about body diagonals of the crystal, thus confirming existing structure information obtained by X-ray studies. In addition, quantities relating to the crystalline electric field gradient at the beryllium sites were determined. Dissert. Abstr.

N69-17773# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN MODELS OF RADIATION DEFECTS IN NONCONDUCTING CRYSTALS
A. Ye. Kiv et al 19 Apr. 1968 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Uz. Ssr, Ser. Fiz.-Mat. Nauk (Tashkent), no. 3, 1963 p 41-43
(AD-679694; FTD-HT-23-222-68) Avail: CFSTI CSCL 20/8

The translation is a brief continuation of another document which discussed the mechanisms of the displacement of atoms in valence crystals during ionization of the inner shells of two adjacent atoms. Application to electron optics is indicated. TAB

N69-17785 Minnesota Univ., Minneapolis.
NOISE PROPERTIES OF GOLD-DOPED SILICON AND GOLD-DOPED GERMANIUM
Michael Bernt Corrigan (Ph.D. Thesis) 1967 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-7292

The electrical noise properties of n-type gold-doped silicon and n-type and p-type gold-doped germanium were investigated in the temperature range from 80°K to 300°K. Measurements were made both with and without optical illumination. The noise spectra of the gold-doped silicon are explained by means of generation-recombination (g-r) noise theory for systems with three participating energy levels, and in one case for a four level model. An unusual feature of the noise for the silicon is the appearance of a local maximum in the spectrum for various temperature and light conditions. This phenomenon occurred in three samples which were investigated extensively under light irradiation and in one of these samples in thermal equilibrium. The noise spectra for the n-type gold-doped germanium have the features of a two level g-r process with the exception that the magnitude of the noise is considerably higher than predicted by theory. The two participating energy levels are the conduction band and the second gold acceptor level lying 0.20 eV below the conduction band. Dissert. Abstr.

N69-17786 Illinois Univ., Urbana.
INFRARED ABSORPTION BY LOCALIZED POLARONS IN THE SILVER HALIDES
Richard Charles Brandt (Ph.D. Thesis) 1967 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-8030

The infrared absorption of silver halide crystals, induced by simultaneous illumination of the crystals with light whose energy exceeded the indirect band gap, was measured from 33 to 2000 cm $^{-1}$ at temperatures from 9°K to 40°K. The induced far infrared absorption was shown to be in agreement with the predictions of an extension of a theory for polarons bound to a positive charge center. In AgBr at 9.3°K, the induced absorption at 168 cm $^{-1}$ was identified as the 1s to 2p transition, and the absorption at 192 $\pm$ 2 cm $^{-1}$ as the 1s to continuum transition. In AgCl at 9.3°K, the corresponding transitions were at 272 cm $^{-1}$ and at 292 $\pm$ 3 cm $^{-1}$. The induced infrared absorption at higher frequencies was shown to be phonon side bands of the far infrared absorption. The longitudinal optical frequencies in AgBr and AgCl were measured directly at low temperatures. At 7°K, the longitudinal optical frequency was 140 $\pm$ 1 cm $^{-1}$ in AgBr, and 197 $\pm$ 1 cm $^{-1}$ in AgCl. Dissert. Abstr.

N69-17841# Pennsylvania Univ., Philadelphia. Dept. of Physics.
A LATTICE THEORY OF THE ELECTRO-OPTIC EFFECTS IN SEMICONDUCTORS
A. A. Maradudin and E. Burstein Dec. 1968 11 p refs
(Contract Nonr-551(51))
(AD-679591; TR-20) Avail: CFSTI CSCL 20/12

A unified lattice theory of the electro-optic effect in semiconductor crystals, which encompasses the piezo-electric and elasto-optic effects, is presented. Expressions are derived for the constant stress and constant strain electro-optic coefficients and the results are specialized to crystals of the zincblende structure.
Author (TAB)

N69-17884 Minnesota Univ., Minneapolis.
THE CRYSTAL STRUCTURES AND CRYSTAL CHEMISTRY OF FERRO-MAGNESIAN AMPHIBOLES
Larry Wayne Finger (Ph.D. Thesis) 1967 81 p
(Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-7309

The crystal structures of grunerite and an anthophyllite have been refined and the Fe-Mg distributions in the octahedral sites have been determined by least-squares using three-dimensional counter intensities. The grunerite, with $a = 9.5642 \pm 0.0007$ Å, $b = 18.393 \pm 0.002$ Å, $c = 5.3388 \pm 0.0003$ Å, $\beta = 101.892 \pm 0.003$ degrees, and space group C2/m, has Fe occupancies of $85.4 \pm 0.9\%$ for M_1, $77.5 \pm 0.9\%$ for M_2, $86.5 \pm 1.4\%$ for M_3, and $98.6 \pm 1.2\%$ for M_4. The anthophyllite, with $a = 18.555 \pm 0.003$ Å, $b = 18.014 \pm 0.002$ Å, $c = 5.2803 \pm 0.0007$ Å, and space group Pnma, has Fe occupancies of $0.6 \pm 2.3\%$ for M_1, $1.8 \pm 2.2\%$ for M_2, $8.5 \pm 3.7\%$ for M_3 and $59.8 \pm 3.7\%$ for M_4. This is the first ferromagnesian amphibole that has significantly different Fe contents in M_1 and M_3. The variation of the unit cell volume with composition has been investigated and regression coefficients for the unit cell parameters have been computed. A new formula for peak widths in equi-inclination geometry has been derived.
Dissert. Abstr.

N69-17939 Virginia Polytechnic Inst., Blacksburg.
QUADRUPOLE SPLITTING OF THE NUCLEAR MAGNETIC RESONANCE SPECTRUM OF Al 27 IN TOPAZ
Kenneth Eugene Yancey (Ph.D. Thesis) 1967 55 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-2080

The quadrupole splitting of the nuclear magnetic resonance spectrum of Al^{27} in a single crystal of topaz has been investigated in a field of 9830 gauss. The asymmetry parameter, the quadrupole coupling constant, and the orientation of the electric field gradient principal axes with respect to the crystalline axes were determined for the sites of the aluminum nuclei in the crystal. Each of the three samples were placed in a homogeneous magnetic field and rotated about a different crystalline axis. The interaction of the electric field gradient at an aluminum site with the electric quadrupole moment of the aluminum nucleus produces a frequency spectrum with four satellites symmetrically located about a central line. The spectrum for each rotation consisted of a central line and two sets of four satellites. Only the two pairs of satellites having the smallest frequency separation were investigated. The frequency interval between two satellites symmetrically located about the central line varies with the orientation of the sample in the static magnetic field.
Dissert. Abstr.

N69-18032# Idaho Nuclear Corp., Idaho Falls. National Reactor Testing Station.
DIPOLE SUM: A COMPUTER PROGRAM FOR CALCULATING DIPOLE SUMS FOR ARBITRARY CRYSTAL
J. K. Boyter and T. G. Worlton Oct. 1968 36 p refs
(Contract AT(10-1)-1230)
(IN-1226) Avail: CFSTI

A Fortran 4 (IBM 7044) program (PPC040°0968) for calculating the dipole sums for an arbitrary crystal is described. Examples are given in the appendixes for BeO (wurtzite structure), Mg_2Sn (fluorite structure), and sodium chloride.
Author (NSA)

N69-18058 Michigan State Univ., East Lansing.
THEORETICAL INVESTIGATION OF THE CONDUCTION BAND CARRIER DENSITY IN InSb UNDER CARRIER MULTIPLICATION CONDITIONS
Paul Elmer Petersen (Ph.D. Thesis) 1967 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-7943

The dependence of the carrier density on the applied dc field strength in a bulk InSb crystal under carrier multiplication conditions is investigated. Calculations relating to a two band model of a semiconductor with spherical energy surfaces and parabolic bands are described. A kinetic approach based on the Boltzmann equation is employed throughout most of the calculations. It is assumed that the distribution function is well represented by the first two terms of a Legendre series and that the density is sufficiently low so that the carriers are nondegenerate and that electron–electron scattering can be ignored. Wherever possible the collison terms are replaced by relaxation-time approximations. A first calculation is performed in which impurity and optical-phonon scattering are neglected; for this case the carrier density is found to increase rapidly near a critical value of the electric field.
Dissert. Abstr.

N69-18081 Illinois Univ., Urbana.
THE EFFECT OF HIGH PRESSURE ON THE THERMOELECTRIC POWER AND RESISTANCE OF ALUMINUM AND GOLD
Ronald Ray Bourassa (Ph.D. Thesis) 1967 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-8029

The effect of pressure up to 4kbar on the thermoelectric power of aluminum, gold, nickel and platinum has been determined. The change in resistance with pressure of aluminum and gold has also been measured. Measurements were carried out at temperatures between room temperature and 1300°K or, in the case of aluminum, between room temperature and 900°K. A null method was used for the resistance measurements and for the thermoelectric power measurements, requiring an externally heated pressure vessel. The use of a special molybdenum alloy made this possible. The high temperature thermoelectric power data for aluminum are separated into terms associated with three thermally activated defects: the monovacancy, the divacancy, and the impurity-vacancy pair. Values for the formation energy and the volume are obtained for each of these defects.
Dissert. Abstr.

N69-18100 Syracuse Univ., N.Y.
THE IMPACT IONIZATION OF IMPURITIES IN GERMANIUM
Nathan Sclar (Ph.D. Thesis) 1967 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-7777

The low temperature electrical breakdown effect in germanium is investigated experimentally as a function of the temperature, magnetic field, background radiation, type and concentration of impurities, geometry and surface treatment, and orientation of the specimens. A study is also made of the time dependence. The effect is shown to involve charge carrier multiplication which is attributed to the impact ionization of neutral impurities by the free charge carriers which gain the necessary energy from the applied electric field.
Dissert. Abstr.

N69-18101 Illinois Univ., Urbana.
RECOMBINATION LUMINESCENCE IN IRRADIATED SILICON
Robert James Spry (Ph.D. Thesis) 1967 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-8233

Radiative recombination of optically injected carriers has been observed in Co^{60} gamma ray- and fast neutron-irradiated float zone grown and pulled silicon. At liquid helium temperature, a complex spectrum, including a very intense band at 0.971 eV, is found in both n- and p-type float zone material. There is an additional similar complex spectrum in both n- and p-type pulled crystals, including a very intense band at 0.791 eV. Both of these intense bands have thermally broadened halfwidths about equal to kT. The major features of both spectra are independent of type and amount of III-V doping impurities, type of radiation, and amount of irradiation up to integrated fluxes of 10^{8}R of gamma rays and $10^{14}/cm^2$ fast neutrons. It is suggested that the luminescence of the two major portions of the spectra are due to the recombination of free holes and trapped electrons in the ground states of two different defects. Dissert. Abstr.

N69-18102 Michigan State Univ., East Lansing.
PHONON DRAG THERMOPOWER IN CADMIUM, ZINC AND MAGNESIUM
Vincent Alan Rowe (Ph.D. Thesis) 1967 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-7957

Anisotropic thermopowers and thermal conductivities of single crystals of the three Group II metals Cd, Zn, and Mg have been measured from 1.25°K to room temperature. An attempt has been made to correlate the phonon drag thermopower in these metals with the detailed topologies of their Fermi surfaces. Dissert. Abstr.

N69-18120 Illinois Univ., Urbana.
ANISOTROPY EFFECTS IN THE CRITICAL FIELD OF SUPERCONDUCTING TIN-INDIUM ALLOYS
David Carey Montgomery (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-6175

Measurements have been made of the critical-field curve, H_c versus T, for eight superconducting dilute alloys of indium in tin near the critical temperature and at low temperatures extending to about 0.3°K. The effective magnitude of the superconducting energy gap is sensitive to the direction of the electron momentum relative to the crystal lattice (the so-called anisotropy effect). The reduction in electron mean free path which occurs upon addition of indium to pure tin reduces the effect of anisotropy in the electron–electron interaction. The decrease in the effect of anisotropy has been observed to depress the critical temperature T_c, the 0°K critical field H_0, and the constant $K = 2\pi\gamma T_c^2/VH_0^2$. In terms of the reduced critical-field curve, impurity additions are found to reduce the deviation from the parabolic law, $h = 1 - t^2$. The observations are explained by theoretical predictions of Clem. Dissert. Abstr.

N69-18138# Minnesota Univ., Minneapolis. School of Physics.
EXPERIMENTAL AND THEORETICAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS Annual Progress Report, 1968
Sep. 1968 35 p refs
(Contract AT(11-1)-1569)
(COO-1569-32) Avail: CFSTI

Experimental and theoretical investigations in solid state and low temperature physics are presented. Subjects include: (1) Josepheson junctions in superconductors, (2) theory of quantum crystals, (3) theory of quantum crystals of helium, (4) theory of nuclear spin system of crystalline ^3He, (5) shape dependent thermodynamic quantities in magnetic systems with dipole interactions, (6) magnetism in metals, (7) superfluidity in liquid helium, and (8) refrigeration. NSA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-17238# Institut Franco-Allemand de Recherches, St. Louis (France).
DETERMINATION OF THE MAGNITUDE OF SMOKE PARTICLES COMING FROM VARIOUS ROCKET PROPULSION FUELS, 1 [VERSUCHSBERICHT UEBER DIE ERMITTLUNG DER TEILCHENGROESSE VON RAUCHPARTIKELN BEI VERSCHIEDENEN RAKETENTREIBSTOFFEN]
H. W. Koch 8 Aug. 1967 21 p refs In GERMAN
(ISL-N-13/67; Rept-1) Avail: CFSTI

Measured are size and concentration of smoke particles from solid rocket fuel combustions. Particles are caught in whisker nets, filtered, adsorbed, and studied by electron microscopy. Results show that carbon black particle size depends on flame temperature, pressure, oxygen content, chemical fuel composition, and original fuel distribution. Carbon black concentration depends on the stoichiometric composition of the investigated fuel system. Transl. by G.G.

N69-17417# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ESTIMATION OF SOLUBILITIES OF GASES IN LIQUID PROPELLANT MIXTURES BY STATISTICAL THERMODYNAMICS Research Document, Jan. – Jul. 1968
Elfreda T. Chang Oct. 1968 24 p refs
(Contract F04701-68-C-0200)
(AD-679982; TR-0200(4210-10)-4; SAMSO-TR-68-464) Avail: CFSTI CSCL 21/9.1

The equations for estimating the solubilities of gases in binary mixtures of liquid propellants from the known solubilities in pure liquid components have been derived by the methods of statistical thermodynamics. The results for the solubilities of gases in the mixtures of hydrazine and unsymmetrical dimethylhydrazine agree well with theoretical calculations. Author (TAB)

N69-17880*# General Dynamics/Fort Worth, Tex.
A STUDY OF CRYOGENIC PROPELLANT MIXING TECHNIQUES. VOLUME 1: MIXER DESIGN AND EXPERIMENTAL INVESTIGATIONS Final Report, Jul. 1967–Sep. 1968
L. J. Poth, Jr., J. R. Van Hook, D. M. Wheeler, and C. R. Kea, Jr. 1 Nov. 1968 324 p refs
(Contract NAS8-20330)
(NASA-CR-73908; FZA-439-1) Avail: CFSTI CSCL 21I

The technology required for predicting the departure of the cryogen from equilibrium conditions (thermal stratification) and the means by which equilibrium conditions can be achieved (mixing) was developed, including a mixer design procedure. Methods of prediction and control of the cryogenic propellant thermodynamic state were studied analytically and experimentally, with stress on the axial jet mixer concept. Small scale pressurized and non-pressurized tanks with water were used to simulate mixing the ullage breakup in large scale cryogenic tanks. The non-pressurized tests permitted visual observation of the basic mixing mechanisms and jet motion. The tests served to verify the analytical predictions and provided data for correlating the predicted dimensionless parameters. Tests with miniature apparatus were also conducted to simulate low-g conditions. The mixer design requirements study was conducted for a system in a nuclear flight module vehicle of a manned Mars mission. K.W.

N69-17881*# General Dynamics/Fort Worth, Tex.
A STUDY OF CRYOGENIC PROPELLANT MIXING TECHNIQUES. VOLUME 2: EXPERIMENTAL DATA Final Report, Jul. 1967–Sep. 1968
L. J. Poth, Jr., J. R. Van Hook, D. M. Wheeler, and C. R. Kee, Jr. 1 Nov. 1968 351 p
(Contract NAS-8-20330)
(NASA-CR-73909; FZA-439-2) Avail: CFSTI CSCL 21I

This volume contains the data obtained from the open- and closed-tank tests. The data are in the form of tabular summaries of test conditions and graphical representations of the test results in both basic and dimensionless forms. Presented first are the results of 58 open-tank tests (non-pressurized), followed by the results of 20 closed-tank tests (pressurized). Data for the open-tank tests consist of jet motion and jet mixing data. Open-tank temperature data consist of the surface and bottom temperatures as a function of time, the differences between surface and mean temperatures, and the difference between mean temperature and mean initial temperature versus time. Closed-tank temperature data are presented in the same manner. Pressure histories for the closed-tank tests are also presented. K.W.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-17213*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
HYDRAZINE ELECTROLYSIS FOR SPACECRAFT PROPULSION: ANALYSIS AND TEST OF A DUAL-MODE GAS AND LIQUID SYSTEM Final Report
Aug. 1968 127 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951720)
(NASA-CR-73753; SSD-80316R) Avail: CFSTI CSCL 21H

Studies on the dual-mode hydrazine spacecraft propulsion system are presented. The three tasks undertaken were: a laboratory and analytical study of the electrolysis of hydrazine, fabrication and test of a breadboard hydrazine electrolysis cell, and design of a prototype dual-mode hydrazine propulsion system. The laboratory studies indicated there are no fundamental problems in the electrolysis process. The breadboard cell was tested as part of a tank assembly that had provisions for gas generation and expulsion in a zero-gravity environment. Design verification tests at normal gravity showed gas expulsion capability was independent of tank attitude. A small amount of liquid was entrained in most gas expulsion events, but this defect is believed to have been corrected. One other problem encountered was a slow decrease of current with operating time. Alteration of anode geometry should eliminate or greatly reduce this effect. Author

N69-17278*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SURVEY OF SALT DEPOSITS IN COMPRESSORS OF FLIGHT GAS TURBINE ENGINES
Richard L. Ashbrook Washington Jan. 1969 26 p refs
(NASA-TN-D-4999) Avail: CFSTI CSCL 21E

Salt concentrations on airfoils of compressors of commercial and military gas turbine engines removed from aircraft for overhaul were measured and compared to concentrations reported to cause stress-corrosion damage in laboratory tests. Concentrations in small local areas were determined, as well as the average concentrations for entire airfoils or for the concave or convex sides alone. Qualitative distributions of salt on airfoils were obtained with contact prints. Average salt concentrations from engines used for long transoceanic flights (a relatively mild exposure) exceeded 0.1 mg/in. (0.015 mg/cm^2). Local concentrations more than 10 times as great were found on some blades. Author

N69-17530# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Aero Propulsion Lab.
DESIGN POINT TURBINE ENGINE PERFORMANCE PROGRAM Technical Report, Jul. 1965–Jun. 1968
R. E. Witherell Sep. 1968 67 p
(AD-680013; AFAPL-TR-68-88) Avail: CFSTI CSCL 21/5

This report describes a digital computer program titled CARPET. CARPET is a computer program that calculates parametric turbojet/turbofan engine performance. It can also analyze the performance of a specific engine. The program is written in Fortran IV language and was designed for use on an IBM 7090 Digital Computer. Included in the report are listings of the complete program, various sample input data and the corresponding output. Author (TAB)

N69-17677# IIT Research Inst., Chicago, Ill.
A PRELIMINARY STUDY OF THE COANDA NOZZLE PRINCIPLE FOR PROPULSION OF TUBE VEHICLES Final Report, 1 Aug. 1967–18 May 1968
Imants Reba Oct. 1968 92 p refs
(Contract DT-7-35512)
(PB-180156) Avail: CFSTI CSCL 13F

The report describes experimental studies to determine the feasibility of a new type of mass transportation, called the IITRI Passive-Vehicle Tube Transport System. This system (1) uses propulsive guideway concepts based on solely fluid dynamical propulsion principles (the Coanda effect). (2) has the utmost mechanical simplicity, with no moving parts other than vehicles. (3) uses small, inexpensive vehicles providing a personalized mode of mass transportation. (4) is suitable for transportation of goods and passengers. The qualitative and quantitative results of the study provide an insight into various problem areas. The following features were demonstrated: (1) High subsonic speed potential (in the experimental model, speeds up to 320 fps were reached). (2) Capability of high vehicular frequency. (3) High load-to-power ratios at speeds above 120 mph and at high vehicular frequencies. (4) System efficiency increases with increasing tube diameter. Author (USGRDR)

N69-17688# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GRAPHIC ANALYSIS OF COMBINED SUPERCHARGER OPERATION
I. A. Chernov 15 Mar. 1968 12 p Transl. into ENGLISH from Tr. Irkutskogo Politekhn. Inst. (Irkutsk) no. 18, 1963 p 186–190
(AD-679816; FTD-HT-23-1391-67) Avail: CFSTI CSCL 21/5

The article presents a graphic method for evaluating the combined operation of gas turbine and drive actuated compressors in a two-stroke cycle engine. TAB

N69-17781*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE AIRFLOW AND AFTERBURNING PERFORMANCE CHARACTERISTICS OF FOUR J85-GE-13 TURBOJET ENGINES

Robert J. Antl and Richard R. Burley Washington Feb. 1969 27 p refs
(NASA-TM-X-1742) Avail: CFSTI CSCL 21E

Tests to calibrate four J85-GE-13 afterburning turbojet engines in support of a flight test program were conducted in an altitude facility. Data were obtained over a simulated altitude range of 15,000 to 55,000 feet and a simulated flight Mach number range of 0.8 to 1.7. Included are data on compressor airflow and interstage bleed characteristics, afterburner temperature rise and total pressure drop, and engine net thrust. The engines were calibrated with the manufacturer's variable area convergent nozzle and four, fixed area, water cooled convergent–divergent nozzles having an expansion ratio of 1.3. Comparisons are shown between the engines tested and with the engine manufacturer's predicted results. Author

N69-17817*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations.
STABILITY CHARACTERIZATION OF ADVANCED INJECTORS Quarterly Progress Report
7 Oct. 1968 40 p refs
(Contract NAS8-20672)
(NASA-CR-98341; QPR-2067-Q-5) Avail: CFSTI CSCL 21H

The model for the Task 1 effort has been defined as the gas tap-off cycle. Because the injection methods for this combustion cycle employ gaseous hydrogen and liquid oxygen or gaseous hydrogen and gaseous oxygen, the combustion stability problems associated with injecting propellants at a density in the order of the combustion gases have been explored. Design and fabrication of test hardware for transverse excitation chamber testing has been completed. Modifications to the test stand to improve the start and shutdown transient pressure and mixture ratio conditions, and additional pressurization capability for increasing the testing duration of the test stand are being made. Testing is planned to start in the month of October. The survey of literature for the formulation of design criteria is nearly completed. An annotated bibliography of forty references is included in this report. Completion of design correlations for the coaxial injector element is planned for the next quarter. Author

N69-17847*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENTS OF SOME PROPERTIES OF A DISCHARGE FROM A HOLLOW CATHODE
George A. Csiky Washington Feb. 1969 36 p refs
(NASA-TN-D-4966) Avail: CFSTI CSCL 21C

A mercury vapor fed hollow cathode of the type used in SERT II Kaufman thrusters was operated in a bell jar. Voltage current characteristics and ranges of mercury flow rate and anode distance were determined for the principal observed discharge modes of spot and plume with discharge currents ranging up to 3 amperes. Plasma potential, electron density, and electron temperature in the uniform potential external discharge were measured by Langmuir probe techniques. Tentative theoretical models of potential distribution are suggested and discussed for the two modes. Author

N69-17911*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
LOW DENSITY PLUME IMPINGEMENT STUDY Quarterly Progress Report, 22 May -25 Aug. 1967
A. W. Ratliff 8 Sep. 1967 30 p refs
(Contract NAS8-21150)
(NASA-CR-98330; LMSC/HREC-A784665; QPR-1) Avail: CFSTI CSCL 21H

A comprehensive literature search concerning the aerodynamics of free jets expanding into a vacuum was carried out. Criteria have been established for continuing flow field calculations through transition and into free molecular flow. A stagnation point convective heating technique, which is valid in a large region of the low density regime, was verified by a comprehensive study. A modified method of characteristics program combined with a normal shock program gives a good analytic description of flow fields. The streamline divergence method for off-windward streamlines has been programmed. A variety of hemisphere-nosecap configurations have been analyzed and the results are included herein. A series of computer programs which calculate radiation from a particle laden rocket exhaust plume have been operated successfully and are considered checked out. Author

N69-17918# Institut Franco-Allemand de Recherches, St. Louis (France).
FIRST EVALUATIONS OF A SMALL PROPULSION UNIT (FOR THE GEC PROGRAM) [ERSTE ABSCHAETZUNGEN EINES KLEINTRIEBWERKES (ZUM GEC-PROGRAMM)]
G. Krauth 1 Dec. 1967 25 p refs In GERMAN
(ISL-N-25/67) Avail: CFSTI

Ballistic parameters of impact velocity, flight time, and impact accuracy are used to estimate the dimensions of a frontal propulsion unit for eliminating resistance to a flying projectile traveling at 1200 m/s. Radiative resistance of 15.96 kp develops at a flight velocity of 1200 m/s when the resistance of the nozzle surface is subtracted from overall estimate. Author

N69-18065*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CHEMICAL PROPULSION RESEARCH AT MSFC
Keith B. Chandler, Peter G. Hass, Robert R., Head, James R. Thompson, Jr., and Ralph G. Weitenbeck *In its* Res. Achievements Rev., Vol. 2 1968 55 p refs (See N69-18059 07-34)
Avail: CFSTI CSCL 21H

The feasibility study of a new semipermanent connector has demonstrated a successful fluid connector design concept which could lead to replacing most of the separable connectors in future space vehicles with the semipermanent connectors. The design features, tooling concept, and development steps are discussed; test data are given. A program was implemented to improve the effectiveness of large diameter vent valves for use in the Lox, fuel, and helium systems of space vheicles. Three areas of research in fluid mechanics are discussed: bubble dynamics, two phase flow, and flow measurement by laser Doppler shift. To find an improved engine for upper stages, two primary paths are being pursued. One is an extension of the capability of the Bell-nozzle engine (by increased chamber pressure); the other is the use of unconventional geometry (e.g., annular combustion chamber and aerospike nozzle). Experimental work in the areas of large LOX/H_2 engines of the J-2 class is summarized. B.P.

N69-18128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF POWER SUPPLY IMPEDANCE ON THE SERT 2 NEUTRALIZER
David C. Byers Washington 1969 29 p refs
(NASA-TM-X-52543) Avail: CFSTI CSCL 21C

The effect of neutralizer keeper power supply impedance on neutralizer performance was investigated with three basic keeper power supplies. Within limits, the required neutral flow rate decreased with increasing keeper supply capacitance (or decreasing

inductance). The change in neutralizer performance reflected by the variation of power supply circuitry tested was such as to change the overall SERT II thruster efficiency by as much as 12 percent. Coherent oscillations of frequencies between about 0.3×10^6 and 0.6×10^6 sec^{-1} were observed on several neutralizer parameters when the neutralizer power supply was capacitive in nature. These oscillations were not studied in detail in the present program. Author

N69-18182# Sud-Aviation, Paris (France).
SOLID PROPELLANT ROCKETS [LES FUSEES A POUDRE]
J. De Montravel Mar. 1968 62 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

General information on solid propellant rockets, especially those of the French space program, is presented to the students. The characteristics and performances of the Belier Centaure-Dragon, Eridane, Dauphin rocket-vehicles are given as well as those of the Diamant third stage rocket. Comparisons between the performance of solid propellant and liquid propellant rockets are also made. ESRO

N69-18202*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL PERFORMANCE OF TURBOJET ENGINE FOR LIGHT SUBSONIC AIRCRAFT
James F. Dugan, Jr. Washington 1969 21 p refs
(NASA-TM-X-52538) Avail: CFSTI CSCL 21E

The performance of a turbojet engine for possible use in a light subsonic airplane is presented. The variation of specific fuel consumption with thrust at both cruise and sea-level static conditions was calculated using component maps. With the design value of exhaust nozzle area, the equilibrium operating line for sea-level static conditions intersects the estimated compressor surge line at 72 percent rotational speed. Thus, some form of variable geometry is required to obtain surge margin below this speed. When compressor exit bleed was used, adequate surge margin was obtained; but very high values of turbine inlet temperature were required. A two-position exhaust nozzle was found to be a better solution. Author

N69-18237# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
NOZZLE ADJUSTMENT PROBLEMS [PROBLEMES D'ADAPTATION DE TUYERES]
Pierre Carrière, Maurice Sirieix, and Jean-Marie Hardy (S.N.E.C.M.A.) 1968 25 p refs In FRENCH; ENGLISH summary Presented at the 32nd AGARD Propulsion and Energetics Group Meeting on the Components of Advanced Technol. for Turbojets Submitted for publication
(ONERA-TP-600) Avail: CFSTI

The optimization of a nozzle is the result of a compromise between various constraints; this leads to discussing the interaction conditions between the internal and external flows downstream of the engine maximum cross-section. In the case of supersonic cruising flight ($M\infty \leq 4$), the various computing methods of the convergent divergent or central body nozzle and afterbody optimum shapes are reviewed. The problems to be solved concern: the eventual evacuation of secondary flows (ventilation, boundary layer bleeds), the confluence of the internal and external flows. The influence of the various optimization factors (nozzle outlet cross-section, boattail shape, etc.) is discussed, the experimental results being compared with the theoretical previsions. In the case of subsonic or transonic cruising flight the theoretical solution of the confluence problem is far from being as advanced as in the supersonic case. After some theoretical considerations, the general experimental results recently obtained in France are outlined. The problem at the off-design flight of a supersonic aircraft is then discussed. Finally, the constraints imposed by the problems of thrust reversal and of the silencer are roughly surveyed. Author (ESRO)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-17215# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
PLASMA PHYSICS IN SPACE RESEARCH
Tatsuzo Obayashi Nov. 1968 14 p refs *Its* Vol. 33, No. 13
(ISAS-431) Avail: CFSTI

The recent achievements in space researches, which are closely linked with the field of plasma physics, are reviewed. Three topics are discussed, which include the solar plasma wind, the collision-free bow shock formed in the sun-ward fringe of the planetary atmosphere, and convective motions of plasma in the magnetosphere. Hydromagnetic behaviors of space plasma, turbulences and various plasma waves observed in space are discussed, with reference to modern fluid dynamics and problems pertinent to plasma physics. Author

N69-17418# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SOLAR PROTON OBSERVATIONS AT SYNCHRONOUS ALTITUDE DURING 1967 Research Document, 1 Jan.–30 Jun. 1968
G. A. Paulikas and J. B. Blake Sep. 1968 32 p refs
(Contract F04701-68-C-0200)
(AD-679977; TR-0200(4260-20)-2; SAMSO-TR-68-444) Avail: CFSTI CSCL 4/1

Measurements of solar protons in the 5-70 MeV energy interval obtained at synchronous altitude during 1967 are presented. The major contributions to the integrated flux were the events of 28 January and 23 May 1967. Author (TAB)

N69-17537# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
THE LOW ENERGY DIFFUSE COSMIC X-RADIATION
B. G. Wilson Aug. 1968 16 p refs *Its* Vol. 33, No. 10, p 289-300
(ISAS-428) Avail: CFSTI

Recent measurements of diffuse X-rays in the 1–10 KeV energy region are reviewed. The results suggest that a single-exponent power-law spectrum, consistent with observations above about 50 KeV, is inadequate at lower energies. It is shown that the trend between 100 and 10 KeV to a flatter spectrum consistent with the 1–10 KeV data may be attributable to the possible existence of electron populations in the metagalaxy with different power-law exponents. Such energy spectra arise naturally from a recent model for the evolution of radio sources. It is suggested that the Felton–Morrison hypothesis of the interaction of metagalactic electrons with 3°K thermal photons may therefore play a dominant role in the origin of the diffuse radiation. Two measurements at 0.25 KeV favor an alternative source of radiation to explain the rather large fluxes in this energy region. Continuation of measurements

linking the 0.25 and 1.0 KeV data is of vital importance in determining the composition and characteristics of the intergalactic gas.
Author

N69-17687# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
SIMULATION OF INTERACTION BETWEEN SUN GENERATED PLASMA WIND AND THE MAGNETIC FIELD OF THE EARTH
G. G. Managadze and I. M. Podgornyi 1967 12 p refs In RUSSIAN; ENGLISH summary
(IAE-1493) Avail: CFSTI

The possibility of simulating the interaction between Sun-generated plasma wind and the magnetic field of the earth is considered. The precise simulation of all processes in the magnetosphere is practically impossible. There is, however, a possibility of selecting the experimental parametars in order to reproduce, in the laboratory, the most interesting cosmic phenomena. As an example of the correctness of limited simulation, the results of the experiments on the formation of a neutral layer are given.
Author (NSA)

N69-17689# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Deep River Lab.
COSMIC RAY NM-64 NEUTRON MONITOR DATA FROM KULA, HAWAII Monthly Graphs, Aug. 1966–Dec. 1967
H. Carmichael, J. F. Steljes and J. W. Maurin (USAF) Sep. 1968 69 p
(AECL-3051) Avail: Atomic Energy of Canada, Ltd., Chalk River: $1.50

Uncorrected and barometer-corrected hourly data from a 3-NM-64 mobile latitude survey neutron monitor stationed at Kula, Maui, Hawaii are given in tabular form for the period from August 1966 to December 1967. Graphs of the corrected data and of the barometric averages are given for the same period. The site is about 1000 m above sea level and the data are corrected to 68.6 cm Hg.
Author

N69-17845*# Harvard Coll. Observatory, Cambridge, Mass.
THE PHOTOSPHERIC ABUNDANCE OF IRON
George L. Withbroe Aug. 1968 46 p refs
(Grant NGL-22-007-006)
(NASA-CR-73952; SR-30) Avail: CFSTI CSCL 03B

The center-to-limb variation of equivalent widths of 198 Fe I lines in the spectral region 5500 to 7000 Å was studied with five photospheric models. The gf-values of Corliss and Warner were used in the analysis. The photospheric iron abundance was found to vary with excitation potential. This can be explained by a systematic error in the gf-values of high excitation lines and an error of 250 to 500 °K in the temperature of the arcs used for measuring the gf-values. Departures from LTE in the solar Fe I lines are also a possibility. The adopted photospheric abundance of iron, $\log (N_{Fe}/N_{H})$ is −5.41.
Author

N69-17934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TYPE 3 RADIO BURSTS IN THE OUTER CORONA
J. K. Alexander, H. H. Malitson, and R. G. Stone Nov. 1968 25 p refs
(NASA-TM-X-63403; X-615-68-442) Avail: CFSTI CSCL 03B

Type III solar radio bursts observed from 3.0 to 0.45 MHz with the ATS-II satellite over the period April to October 1967 were analyzed to derive two alternative models of active region streamers in the outer solar corona. Assuming that the bursts correspond to radiation near the electron plasma frequency, pressure equilibrium arguments lead to streamer Model I in which the streamer electron temperature derived from collision damping time falls off much more rapidly than in the average corona and the electron density is as much as 25 times the average coronal density at heights of 10 to 50 solar radii. In Model II the streamer electron temperature is assumed to equal the average coronal temperature, giving a density enhancement which decreases from a factor of 10 close to the Sun to less than a factor of two at large distances ($> 1/4$ A.U.). When the burst frequency drift is interpreted as resulting from the outward motion of a disturbance that stimulates the radio emission, Model I gives a constant velocity of about 0.35c for the exciting disturbance as it moves to large distances, while with Model II, there is a decrease in the velocity to less than 0.2c beyond 10 solar radii.
Author

N69-17962*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN X-RAY SURVEY OF THE SKY FROM BALLOON ALTITUDES, DECEMBER 1965–JULY 1967
Guenter Rudolf Riegler (Ph.D. Thesis—Md. Univ., College Park) Jan. 1969 193 p refs
(Grant NGL-21-002-033)
(NASA-TM-X-63422; X-611-69-1) Avail: CFSTI CSCL 20H

A series of balloon borne X-ray experiments was carried out between December 1965 and July 1967. The X-radiation in the energy band from 12 to 60 keV was detected with a combination of proportional and scintillation counters. A clear relation between the background counting rate at a residual atmospheric depth of 3 g/cm^2 and the geomagnetic latitude was found. The secondary atmospheric X-ray background is assumed to be a component of atmospheric electromagnetic cascades which originate in the collisions of high energy cosmic ray particles with atmospheric nuclei; other X-ray production processes near the top of the atmosphere are shown to be insufficient to explain the observed secondary background. The correct prediction of the geomagnetic latitude effect is shown to constitute a stringent test for models of atmospheric X-ray production. Two observations of the Crab Nebula (Tau XR-1) resulted in net source spectra which can be described by a power law photon spectrum with a spectral index of $-0.09 \leq n \leq -1.93 \leq +0.13$. A comparison with the results of measurements by other experimenters at lower and higher energies indicates that the X-ray spectrum of Tau XR-1 is a power law of index $n \simeq 2.0$ at energies between 2 and 400 keV.
Author

N69-17978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROMAGNETIC SHOCKS IN THE SOLAR WIND
K. W. Ogilvie and L. F. Burlaga Jan. 1969 24 p refs
(NASA-TM-X-63449; X-616-69-29) Avail: CFSTI CSCL 20H

The Rankine–Hugoniot relations are applied to shock-like discontinuities measured by both magnetic field and plasma instruments on the satellite Explorer 34 between May 30, 1967 and January 11, 1968. Shock normals were either determined from the magnetic field observations, or from the times of occurrence of the discontinuity at Explorers 33, 34 and 35. The Rankine–Hugoniot relations are obeyed to the accuracy of the observations, and the values of shock velocities, density ratios, and Mach numbers indicate that at 1 AU the typical interplanetary shock is not strong, although all the events studied caused geomagnetic impulses.
Author

N69-17991*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF MAGNETIC SURVEYS OF THE MAGNETOSPHERE AND ADJACENT REGIONS

Masahisa Sugiura Jan. 1969 37 p refs Presented at the IAGA Symp. on Description of the Earth's Magnetic Field, Washington, D. C., 22–25 Oct. 1968 Submitted for publication
(NASA-TM-X-63446; X-612-69-12) Avail: CFSTI CSCL 04A

Magnetic field observations in the magnetosphere and in the adjacent regions are reviewed. Extensive observations of the positions of the magnetosphere and the bow shock have been made below about geomagnetic latitude 65°; frequent movements of the magnetopause and the bow shock are inferred from multiple encounters. The magnetopause thickness is estimated to be of the order of the ion cyclotron radius. The interplanetary magnetic field is convected into the magnetosheath, and comprises the ordered background field in the magnetosheath; irregular fields are superimposed on the ordered magnetic field. Both the magnetic field and the charged particle content of a ring current have been measured during magnetic storms. A proton belt of lesser intensity has been observed even during magnetically quiet periods. Appreciable diamagnetic effects of the plasmas in the outer magnetosphere are indicated. Sudden magnetic variations are observed in the near-tail region near the magnetic midnight meridian following the onsets of magnetic bays. A few quantitative models of the magnetosphere have been presented. Author

N69-17995*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BOW SHOCK ASSOCIATED WAVES OBSERVED IN THE FAR UPSTREAM INTERPLANETARY MEDIUM
D. H. Fairfield Nov. 1968 42 p refs
(NASA-TM-X-63409; X-616-68-454) Avail: CFSTI CSCL 03B

Fifty orbits of Explorer 34 data have been used to study .01–.05hz transverse waves in the interplanetary medium region between the bow shock and the spacecraft apogee of 34 R_E. It is concluded that the waves are associated with the earth's bow shock since they only occur when projection of the interplanetary field observed at the spacecraft intersects the shock. The waves are observed 18.5% of the time when a total of 134 days of interplanetary data is considered, but more than 90% of the time when the field has the proper orientation with respect to the bow shock. On the basis of this result it is suggested that these waves with 20–100 second periods are a permanent feature of the solar wind-earth interaction. The transverse component of the waves is typically several gammas in amplitude in 4–8 gamma fields. The disturbance vector in the XY plane generally exhibits the same sense of rotation in a coordinate system where the field is oriented along the positive z axis. Author

N69-17996*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTODISINTEGRATION OF ULTRAHIGH ENERGY COSMIC-RAYS BY THE UNIVERSAL RADIATION FIELD
F. W. Stecker Dec. 1968 11 p refs
NASA-TM-X-63411; X-641-68-480) Avail: CFSTI CSCL 20H

A detailed calculation to determine the effectiveness of the universal radiation field in disintegrating ultrahigh energy cosmic-ray nuclei is presented. It is concluded that this process cannot explain the air-shower observations above 10^{17} eV unless there exists a large metagalactic flux of infrared photons as may have recently been detected. Other implications of the results are discussed. Author

N69-18033*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREDICTION OF EXTRAGALACTIC GAMMA-RAY FLUXES BETWEEN 1 AND 100 MeV
F. W. Stecker and Joseph Silk (Inst. of Theoret. Astronomy, Cambridge, Engl.) Dec. 1968 13 p refs Supported in part by NAS-NRC
(NASA-TM-X-63421; X-641-68-492) Avail: CFSTI CSCL 20H

The observed isotropic cosmic X- and gamma-rays may be produced by some combination of four possible types of extragalactic interactions. It is shown that spectra from these interactions have important distinguishing characteristics in the 1–100 MeV energy range. By normalizing the theoretical spectra to the observed intensities, theoretical intensities of metagalactic cosmic-ray protons and electrons needed to account for the observed radiation are determined. Author

N69-18093 Minnesota Univ., Minneapolis.
PROTON AND HELIUM NUCLEI COSMIC RAY SPECTRA AND MODULATIONS BETWEEN 100 AND 2000 MeV/NUCLEON
Jonathan F. Ormes (Ph.D. Thesis) 1967 93 p
Avail: Univ. Microfilms: HS $4.80/Microfilm $3.00 Order No. 68-7365

During the years 1963–1966, an extensive series of balloon flights has been conducted in order to study the primary cosmic radiation and its time variations. The instrument used is a Cerenkov-scintillation counter telescope, the most recent version of which contains two dE/dX detectors, a combination Cerenkov and scintillation detector and a range scintillator. This telescope and its response characteristics to protons and helium nuclei are described. Convolution techniques are used to unfold the Landau fluctuations in energy loss. The differential energy spectra derived by this technique are presented from nine balloon flights. The data is examined to determine the functional form of the solar modulation by comparing the sunspot minimum spectrum obtained in 1965 with the pre-sunspot minimum spectrum obtained in 1963 and the post sunspot minimum spectrum obtained in 1966. Dissert. Abstr.

N69-18108*# Rice Univ., Houston, Tex. Dept. of Space Science.
A PULSAR EMISSION MECHANISM
F. C. Michel and W. H. Tucker Feb. 1969 16 p refs
(Grant NGL-44-006-033)
(NASA-CR-99490) Avail: CFSTI CSCL 03B

We point out that the interaction between two basic types of plasma discontinuities in relative motion, namely the tangential and shock discontinuties, should result in pulsed emission of electromagnetic radiation. These discontinuities are both observed in the interplanetary plasma flow. Currents must flow on these discontinuities, and the radiation is generated by the acceleration of these currents at the intersection points of the shock and tangential discontinuities. Under conditions thought applicable to pulsars, NP 0532 would radiate about 4×10^{30} erg/sec of radio energy below about 10^3 MHz. The efficiency of this mechanism is quite low ($\approx 10^{-8}$ for NP 0532) for the assumed conditions, and direct extention to the much slower pulsars would require that they have moments of inertia much larger than attributable to neutron stars. Author

N69-18175*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCRETE SOURCE INTERPRETATION OF RECENT HIGH-ENERGY COSMIC GAMMA-RAY MEASUREMENTS
Hakki Oegelman Dec. 1968 11 p refs
(NASA-TM-X-63420; X-611-68-487) Avail: CFSTI CSCL 20H

Gamma ray detector data, obtained during OSO-3 flight, show an angular distribution of events. The theory that most of this flux is due to unresolved discrete sources is evaluated by predicting the spectral index from total measured fluxes in the X-ray

and gamma ray region and by comparing it to measurements of the power law index in the soft and hard X-ray region; the extrapolated X-ray power law differential exponent evolved as −2.1. This predicted −2.1 spectra fits well with experimental measurements up to 0.5 MeV. The fact that one single spectral index may account for the fluxes from X-ray to high energy gamma ray region implies that the mechanism responsible for this emission could not be synchrotron radiation because of the short lifetimes of electrons radiating the gamma rays. G.G.

N69-18209# Centre National de la Recherche Scientifique, Verrieres-Le-Buisson (France).
MEASUREMENT OF SOLAR ULTRAVIOLET RADIATION DURING A TOTAL ECLIPSE [MESURE RAYONNEMENT ULTRA VIOLET DU SOLEIL PENDANT UNE ECLIPSE TOTALE]
C. Malique [1968] 36 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

A rocket-borne spectroheliophotometer experiment to measure the variation of the 1216–2400 Å emission at the edge of the solar disk during an eclipse is described. The characteristics of the optical instruments are given as well as details of a method used to calibrate the spectroheliophotometer and the ionization chamber. The data reduction procedures and the preliminary results are also discussed. ESRO

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-17202*# Boston Univ., Mass.
ON THE FORMATION OF THE MOON BY ACCRETION OF SOLAR OR PLANETARY MATERIAL
J. Anthony Burke May 1968 17 p refs
(Grant NsG-246)
(NASA-CR-73677; RR-18) Avail: CFSTI CSCL 03B

As part of an evolutionary study of planetary systems, the conditions in which material would be accreted by a gravitating ring located in a fluid stream are evaluated. To simplify the solution of the problem, the flow configuration is approximately represented by a stream which is uniform at large distances and which impinges on cylindrical, gravitating body. The accretion problem is treated as being two-dimensional and both subsonic and supersonic. K.W.

N69-17261*# National Aeronautics and Space Administration, Washington, D.C.
MARINER MARS 1969 LAUNCHES: PRESS KIT
14 Feb. 1969 58 p
(NASA-News-Release-69-26) Avail: NASA Scientific and Technical Information Division CSCL 22A

Preflight information on Mariner F and G flyby missions to Mars includes mission profile and spacecraft and launch vehicle design data. Launched by the Atlas–Centaur launch vehicle, the two spacecraft will be targeted to observe different regions of Mars. The spacecraft will contain instruments designed to return information on Mars itself, with a sharp increase in data returns expected over the '64-65 Mariner missions. The experiments are designed to yield data on the physical, chemical and thermal properties of the planet's surface and atmosphere and to refine astronomical data. Television cameras aboard each spacecraft will photograph the disc of Mars during the approach to the planet and the surface during the flyby. An infrared spectrometer and an ultraviolet spectrometer will probe the atmosphere, while an occultation experiment will yield data on atmospheric pressures and densities. Surface temperatures on both the light and dark sides of Mars will be measured. Tracking and data systems information and project personnel and contractors are also provided. S.P.G.

N69-17305*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
TWO-BURN ESCAPE MANEUVERS WITH AN INTERMEDIATE COASTING ELLIPSE
Edward A. Willis, Jr. Washington Feb. 1969 31 p refs
(NASA-TN-D-5011) Avail: CFSTI CSCL 22C

Escape maneuvers having two burns separated by a coasting ellipse are compared with conventional single-burn maneuvers for low circular initial orbits and a wide range of launch energies. One- and two-stage vehicles with nuclear and chemical propulsion are considered. This two-burn escape mode yields significantly lower initial mass and engine size, and improved launch window capability. Author

N69-17397*# American Nucleonics Corp., Glendale, Calif.
THE EARLY DESPINNING OF THE SUN
K. Schwartz and G. Schubert (California Univ., Los Angeles) 17 Feb. 1969 12 p refs
(Contract NAS2-2153)
(NASA-CR-73293) Avail: CFSTI CSCL 03B

It is shown that if the Sun passed through a T Tauri stage, then a mass loss of only 15% would be sufficient to despin the Sun to an angular velocity of $0(10^{-5}$ rad/sec) at 10^7 years without the additional breaking effect of an enhanced magnetic field. Thus the present Sun could have a core rotating at most ten times faster than its surface. Author

N69-17403 Catholic Univ. of America, Washington, D. C.
A SEARCH FOR GAMMA-RAYS FROM THE CRAB NEBULA USING A DIGITIZED SPARK CHAMBER
Donald Avery Kniffen (Ph.D. Thesis) 1967 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-9253

No γ-ray point source has been detected for certain; however, several significant upper limits to possible sources have been obtained. One of the most likely sources, the Crab nebula, was chosen for investigation in this experiment. The detector developed for this investigation is a digitized spark chamber. The active chamber area contains a stack of 32 spark modules interleaved with 30 thin gold plates. The triggering telescope consists of an anticoincidence scintillator surrounding the entire detector and a scintillation counter-Cerenkov detector charged-particle telescope. Any neutral particle passing through anticoincidence dome and converting within the chamber actuates the high voltage pulser, applying high voltage across the grids of each module. The detector is mounted in an oriented gondola and flown by balloon above all but a small amount of the earth's atmosphere. Analysis of the data consists of examining each event recorded during the flight for the pair-production events. Though no celestial source of gamma-ray was detected, upper limits of 2.2 and 1.8×10^{-4}/cm^2 sec were obtained for photons from the Crab nebula with energies $30 \leq E_\gamma \leq 100$ and $E_\gamma > 100$ MeV, respectively. The differential and integral energy spectra of gamma-rays produced in the atmosphere at a depth of 3 g/cm^2 were obtained in the 30–290 MeV energy range. Dissert. Abstr.

N69-17411*# Florida Univ., Gainesville. Dept. of Physics and Astronomy.
DEVELOPMENT OF AN ORBITAL RECEIVER FOR LOW-FREQUENCY RADIO ENERGY FROM THE PLANET JUPITER Final Report
A. G. Smith and G. R. Lebo 7 Feb. 1969 189 p refs
(Contract NASr-176)
(NASA-CR-73885) Avail: CFSTI CSCL 22A

Proposed is a series of radiofrequency experiments to be performed by the Pioneer F/G Asteroid-Jupiter spacecraft. The proposed experiments are aimed at elucidating the positions, spectra, polarization, sizes, and motions of the powerful decametric sources on Jupiter, as well as studying the effect of the interplanetary medium (including the asteroid belt) on the radiation. Measurements will provide critical tests of theories suggesting that the Jovian radiation is confined to sharp, geometrical beams. A related experiment will use the antenna system to measure ambient plasma density in the interplanetary medium, the asteriod belt, and the Jovian magnetosphere, both as an end in itself and as an important aid in interpreting the radio data. The results are expected to contribute substantially to our understanding of the radiation mechanisms and physical environment of the largest planet in the solar system, as well as the interplanetary medium itself. As a cost-free by-product, the low-frequency solar bursts that will be recorded will provide information on the outer corona at a time of sunspot minimum. Author

N69-17426 College of William and Mary, Williamsburg, Va.
COLLECTIVE EFFECTS IN STELLAR DYNAMICS AND PLASMA PHYSICS
Frank Hohl (Ph.D. Thesis) 1967 282 p
Avail: Univ. Microfilms HC $12.85/Microfilm $3.65 Order No. 68-7835

The major part of the thesis is concerned with the stability and evolution of stellar systems. One- and two-dimensional models are used to perform computer experiments tracing the evolution of stellar systems. The stationary solution of the Vlasov equation for a one-dimensional system of stars as computed for an interesting class of initial conditions is found to correspond to a minimum energy configuration. A variational principle has been applied to the one-dimensional stellar system to show that stationary distribution functions which decrease monotonically in going outward from the center of the system are stable. Other stationary distributions may be unstable as is illustrated by means of computer experiments. The one-dimensional model is of interest as an approximation to the distribution of velocity and mass normal to the galactic plane of a highly flattened galactic system. Numerical experiments with a simple two-dimensional rod model show that the spiral structure and other filamentary structure of galaxies may result from purely gravitational effects. Dissert. Abstr.

N69-17435# Aerospace Corp., El Segundo, Calif. Lab. Operations.
COMPUTER GENERATED PHOTOS OF RAPIDLY SCANNED 3.3-mm SUN MAPS Document Research, Jun. 1967–Jul. 1968
Fred I. Shimabukuro and John P. Oliver Jul. 1968 37 p refs
(Contract F04701-68-C-0200)
(AD-679979; TR-0200(4230-46)-4; SAMSO-TR-68-446) Avail: CFSTI CSCL 3/2

A continuous scanning technique has been developed to make complete 3.3-mm maps of the sun in 4.5 min with an antenna having a half-power beamwidth of 2.8 arc-min. A computer program that generates 35-mm photographs from the matrix of radiometric readings is described. Time lapse films of 3.3-mm sun maps with a time resolution of several minutes can be made. Consequently, studies of the rapid time development of active regions at millimeter wavelengths are now possible. Author (TAB)

N69-17458# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OBSERVATIONS 3.4-MM AND 1.4-MM OF THE LUNAR ECLIPSE ON 18 OCTOBER 1967, SEPTEMBER 1967–JUNE 1968
Earl E. Reber and Joseph M. Stacey Oct. 1968 21 p refs
(Contract F04701-68-C-0200)
(AD-679774; TR-0200(4230-46)-2; SAMSO-TR-68-417) Avail: CFSTI CSCL 3/2

Radiometric measurements of selected lunar areas are reported for the lunar eclipse of 18 October 1967. Observations were made simultaneously at 3.4- and 1.4-mm wavelength with half-power antenna beamwidths of 3.3 arc min and 1.78 arc min, respectively. Temperature changes and cooling rates observed at 3.4 mm are in good agreement with the temperature changes measured on the same areas observed at 3.2 mm during the 30 December 1963 lunar eclipse. Within the precision of the measurements, as limited by atmospheric variations and radiometer noise, there is no statistically significant difference in the cooling rates between any two observed lunar areas at 3.4 mm. Similarly, there is no statistically significant difference between the cooling rates between any two lunar areas measured at 1.4 mm. The 3.4-mm observations of the 18 October 1967 eclipse are compared with the 3.2-mm observations of the 30 December 1963 eclipse. The same lunar areas were measured during both eclipse events (Copernicus, Mare Serenitatis, and a mountainous region). Author (TAB)

N69-17528# Rand Corp., Santa Monica, Calif.
REFLECTION AND TRANSMISSION FUNCTIONS FOR FINITE ISOTROPICALLY SCATTERING ATMOSPHERES WITH SPECULAR REFLECTORS
J. L. Casti, R. Kalaba, and S. Ueno Nov. 1968 49 p refs
(Contract F44620-67-C-0045; Grant NSF GP-294)
(AD-679781; RM-5802-PR) Avail: CFSTI CSCL 3/2

The report gives the derivation of invariant imbedding equations for the diffusely reflected and transmitted radiation of an isotropically scattering and absorbing planetary atmosphere bounded below by a smooth, mirrorlike reflecting surface and illuminated by parallel rays of sunlight. First the integral equation for the source function is given and from it are derived the invariant imbedding equations. These are solved numerically by gaussian quadrature and the results are then used to produce the first known tables of the diffuse reflection function for a wide range of optical thicknesses and albedos for single scattering. Tables of the diffusely transmitted radiation, i.e., the radiation incident on the bottom specular reflector, are also given. This study provides a necessary first step toward the computational treatment of more realistic models of atmospheres involving anisotropic scattering, sphericity, frequency dependence, and other factors. It aids in the assessment of the role of a bottom specular reflector, e.g., a smooth sea-atmosphere interface. Subsequent studies will be devoted to the determination of the source function and to the solution of inverse problems. Author (TAB)

N69-17539# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COSMIC MASER
M. A. Korets et al 5 Apr. 1968 9 p Transl. into ENGLISH from Priroda (Moscow), v. 55, no. 9, 1966 p 117–119
(AD-679691; FTD-HT-23-1596-67) Avail: CFSTI CSCL 3/2

Professor I. S. Shklovskiy reported on the most recent work on the radio emission of neutral hydrogen at a scientific session of the Division of General and Applied Physics of the Academy of Sciences. He believes that a cosmic maser arises where there is a condensation of the interstellar medium with a density of approximately 30,000 times more than the mean value. Such condensations apparently are protostars. Due to the great intensity of radiation of such a maser radioastronomers can judge the birth of a star even in the most distant corner of the Galaxy. TAB

N69-17614# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
HIGH-RESOLUTION INTERFEROMETRY OF VENUS AT 3.12 cm WAVELENGTH
Glenn L. Berge and Eric W. Greisen 1968 29 p refs
(Contract N00014-67-A-0094)
(AD-679649; Rept-1968-6) Avail: CFSTI CSCL 3/2

The two-element interferometer at the Owens Valley Radio Observatory was used in September, 1967, to measure the 3-cm brightness and polarization distributions of Venus near inferior conjunction. The limbs were found to be unpolarized to a very low upper limit. Limb-darkening was observed, but no departures from circular symmetry could be detected. Apparently the Venus atmosphere supplies most of the radiation observed at this wavelength. Venus was also observed briefly at 7.5 cm with low resolution. Author (TAB)

N69-17618# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
RADIO SOURCES AND ELLIPTICAL GALAXIES
David H. Rogstad and Ronald D. Ekers 1968 33 p refs
(Contract N00014-67-A-0094)
(AD-679650; REPT-1968-9) Avail: CFSTI CSCL 3/2

One hundred ninety-one E and SO non-cluster galaxies with known redshift have been surveyed for radio emission at a frequency of 2640 MHz. The observations support the hypothesis that an elliptical galaxy must have an absolute photographic magnitude brighter than -20 to be a strong radio source. A comparison of the results of this survey with observations of radio galaxies in rich clusters indicates that cluster membership does not enhance the probability of an elliptical galaxy being a radio emitter. In addition to the strong radio sources, several E and SO galaxies were found to have weaker radio emission associated with them, but their absolute radio luminosity was still on the order of 100 times larger than that for detected spiral galaxies. Author (TAB)

N69-17655# California Inst. of Tech., Pasadena. Valley Radio Observatory.
POSITIONS AND STOKES PARAMETERS OF SEVEN OH EMISSION SOURCES
Ernst Raimond and Baldur Eliasson 1968 40 p refs
(Contract N00014-67-A-0094)
(AD-679895; REPT-1968-8) Avail: CFSTI CSCL 3/2

The two-element variable baseline interferometer of the Owens Valley Radio Observatory has been used to determine positions of the OH sources near the galactic radio sources W3, Ori A, NGC6334, Sgr B2, W49, W51 and W75. The accuracy of the absolute positions is 4 sec. to 6 sec., that of relative positions of different features belonging to one source is approximately 3 sec. The relative distances between different components of one source seem to be either between 0.0 and 0.1 pc or between 1 and 10 pc. The sample of sources may be too small to conclude whether this is a significant property of OH emission centers. There is a strong indication that four of the OH sources (W3, Ori A, W51 and W75) are located near regions of infrared activity. For three sources spectra in terms of Stokes parameters are given for the 1665.401 MHz line and for the 1667.358 MHz line. The remaining four sources have been observed at 1665.401 MHz only. Strong circular polarization characterizes the spectra of most sources, but many unpolarized and weakly polarized features have been found in the spectra of the Ori A and W51 sources. Author (TAB)

N69-17727*# P.E.C. Research Associates, Inc., Boulder, Colo.
RADIATIVE ASPECTS OF LUNAR MATERIALS Final Report
R. Sexl, D. Burkhard, H. Folk, J. Nance, H. Sexl, et al [1968] 141 p refs
(Contract NAS8-21044)
(NASA-CR-98325) Avail: CFSTI CSCL 03B

Various aspects of the intensity and angular distribution of visible and infrared radiation leaving the lunar surface were studied. A crater model for lunar thermal radiation was developed and showed good agreement with measured directional radiation characteristics. This mathematical model can be used for machine calculations of view factors and thermal fluxes near the lunar surface. Hapke's photometric function model was modified in order to conform more closely to physical conditions and to provide a rationale for separating the derivation of Hapke's retrodirective function from the effect of random local variations in the slopes of the lunar surface material. Stochastic processes and stochastic differential equations were prepared for analyzing the lunar surface interaction with incident electromagnetic radiation. G.G.

N69-17728*# North American Rockwell Corp., Downey, Calif. Space Div.
A STUDY OF AN EXTENDED LUNAR ORBITAL RENDEZVOUS (ELOR) MISSION. VOLUME 1: TECHNICAL ANALYSIS Final Report
Roy B. Carpenter, Jr. Jan. 1969 318 p refs
(Contract NAS2-4942)
(NASA-CR-73295; SD-68-850-1) Avail: CFSTI CSCL 22A

The feasibility of using the extended orbital rendezvous concept as a personnel delivery system for post-1975 lunar exploration programs was studied. Available optimal system and mission designs were incorporated into a mission system with a high probability that its functions will be available when and where required. Results indicated that the extended lunar orbital rendezvous mission as a personnel carrier, together with one of several logistic missions, provide an attractive combination for extended lunar explorations using a minimum of hardware. G.G.

N69-17729*# North American Rockwell Corp., Downey, Calif. Space Div.
A STUDY OF AN EXTENDED LUNAR ORBITAL RENDEZVOUS (ELOR) MISSION. VOLUME 2: SUPPLEMENTAL DATA Final Report
Roy B. Carpenter, Jr. Jan. 1969 169 p refs
(Contract NAS2-4942)
(NASA-CR-73296; SD-68-850-2) Avail: CFSTI CSCL 22A

Presented are supplemental data generated during a study of space mission duration-extension problems in an extended lunar orbital rendezvous mission. Data derived from a baseline study and the mission system design cover data links, power systems, manned phase operations and component materials and utilizations. G.G.

N69-17730*# North American Rockwell Corp., Downey, Calif. Space Div.
A STUDY OF AN EXTENDED LUNAR ORBITAL RENDEZVOUS (ELOR) MISSION. VOLUME 3: SUMMARY OF RESULTS
Roy B. Carpenter, Jr. Jan. 1969 32 p refs
(Contract NAS2-4942)
(NASA-CR-73296; SD-68-850-3) Avail: CFSTI CSCL 22A

Developed are optimum system and mission design parameters for extended manned space missions by establishing a reasonable balance among system and mission performance, reliability, maintenance, operability, and controlled utilization. The logic of this analytical technique is presented and applied to determine an improved lunar cargo and personnel delivery system for the extended lunar orbital rendezvous mission. It provides for a three-man crew

on the lunar surface for up to 90 days. Hardware requirements are based on maximum use of existing systems and minimum development costs. G.G.

N69-17768# Dabcovich and Co., Inc., Lexington, Mass.
SEVEN PROJECTS IN STELLAR AND UPPER ATMOSPHERIC PHYSICS, PART 2 Final Report, Feb. 1967–Aug. 1968
Robert F. Boudreau, Milan R. Dabcovich, Kenneth Dieter, Jonathan D. Fridman, Shu T. Lai et al Nov. 1968 107 p
(Contract F19628-67-C-0227)
(AD-679758; AFCRL-68-0619-PT-2) Avail: CFSTI CSCL 3/2

Computer programs written for seven projects are analyzed. These include: Determination of star temperatures using shifts in titanium lines; Determination of an optimum mathematical filter to minimize the discrepancy between a given signal and an ideal signal the power spectrum of which is known; Correlation of weather information from a multistation experiment; Auroral temperatures computed using spectral lines observed in Fabry-Perot interferometers; Magnetic tape regeneration technique; Studies in the time variance of ionospheric power distributions through the analysis of ionospheric RF Band reflectivity patterns; Studies in ionospheric drift. Author (TAB)

N69-17799# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
EAST-WEST FOURIER TRANSFORMS OF POLARIZATION PARAMETERS OF RADIO SOURCES AT 1418 MHz, VOLUME 1, NUMBER 4
G. A. Seielstad and K. W. Weiler 1968 51 p refs
(Contract N00014-67-A-0094)
(AD-679897) Avail: CFSTI CSCL 3/2

As part of a continuing study employing the Owens Valley Radio Observatorys twin-element interferometer to provide high angular resolution measurements of the various radio source properties the Fourier transforms of the distributions of the Stokes parameters Q, U, and V were measured at several antenna spacings along an east-west baseline. The present paper catalogs these measurements, while a subsequent paper will interpret them in terms of the structure of the polarized radiation along a circle of constant declination. Author (TAB)

N69-17815*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL AND DIELECTRIC PROPERTIES OF A HOMOGENEOUS MOON BASED ON MICROWAVE AND INFRARED TEMPERATURE OBSERVATIONS
Ted A. Calvert Washington Feb. 1969 43 p refs
(NASA-TM-X-1734) Avail: CFSTI CSCL 03B

A homogeneous lunar model was used to establish theoretically the relationship of the thermal properties of the moon to its dielectric properties. This was accomplished using lunar observational data obtained in the microwave and infrared wavelengths. Measured values of loss tangent, dielectric constant, and thermal diffusivity for postulated lunar materials are compared to values calculated from microwave and infrared observations. Lunar microwave brightness temperatures are compared to subsurface temperatures based on selection of a thermal parameter and a depth into the lunar interior. The measured values of loss tangent and dielectric constant for the postulated materials agree with the values based on lunar observations; however, it is not possible to establish which sample offers the best comperison. The microwave brightness temperature curves do not offer good agreement with the calculated subsurface temperatures since the phase lag and amplitudes could not be made to agree simultaneously. As a result, it may be possible to use the homogeneous model to relate the electrical properties of the lunar material to its thermal properties. Author

N69-17824# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
BIBLIOGRAPHY OF LUNAR AND PLANETARY RESEARCH SUPPLEMENT NO. 3, 1967
J. W. Salisbury ed. Oct. 1968 311 p refs Submitted for publication *Its* Spec. Rept. No. 82
(AD-679995; AFCRL-68-0533) Avail: CFSTI CSCL 3/2

A bibliography of lunar and planetary research articles published during 1967 is presented with both subject and author listings. The major subject categories are: astrobiology, comets, meteorite craters and cratering effects, meteors and meteorites, the moon, origin of the solar system, the planets, and tektites. Each article is abstracted. Author (TAB)

N69-17840# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
EAST-WEST LINEAR POLARIZATION DISTRIBUTIONS OF RADIO GALAXIES AT 1418 MHz
G. A. Seielstad and K. W. Weiler 1968 137 p refs
(Contract N00014-67-A-0094)
(AD-679894; Rept-7) Avail: CFSTI CSCL 3/2

The distributions along a circle of constant declination of the linearly polarized radiation at a frequency of 1418 MHz from 68 extragalactic radio sources were examined. The effective resolution was about 0.8. At places within many sources very high degrees of polarization (> 15 per cent), usually accompanied by a constant plane of polarization, were found. Both facts imply the existence of a highly ordered magnetic field. Often other regions within the same source also contained uniform fields, but oriented differently. Less frequently the field is well-ordered over an entire component or even over the entire source. These regions of uniformity can exceed galactic dimensions (about 100 kpc). Author (TAB)

N69-17862 Florida Univ., Gainesville.
PHOTOELECTRIC PHOTOMETRY OF CZ AQUARII AND UV PISCIUM
Roger Byington Carr (Ph.D. Thesis) 1967 122 p refs
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-9517

Two eclipsing binary star systems were studied in detail with the techniques of photoelectric photometry. The observations were made with a sixteen-inch reflecting telescope at the Kitt Peak National Observatory, Tucson, Arizona. Observations were made in three colors, corresponding to the colors of the (U,B,V) system of Johnson and Morgan but no transformations to the standard system were determined. A total of 360 observations in yellow and blue and 359 observations in ultraviolet was obtained for the system CZ Aquarii, and 437 observations in each color were obtained for the system UV Piscium. Atmospheric extinction and light time corrections were applied to the observations. The extinction coefficients were determined from the observations of the comparison stars. Dissert. Abstr.

N69-17863 California Univ., Berkeley.
MARS: VISIBLE AND NEAR INFRARED STUDIES AND THE COMPOSITION OF THE SURFACE
Brian Todd O'Leary (Ph.D. Thesis) 1967 187 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-10386

An extensive analysis of polarimetric, photometric, and spectrophotometric measurements of Mars is performed. Dollfus and Focas' polarimetric observations are discussed. It is concluded that because of the uncertainty in the atmospheric brightness and polarization contributions to the observed brightness and polarization of Mars, the range of possible polarizations of the Martian bright

areas at a given phase angle and wavelength would encompass the polarizations of many powdered substances measured in the laboratory; e.g., limonites, desert sand, augite, red sandstone, and volcanic ashes. Even if the atmospheric component has been assessed correctly, there is still not the close match in polarization between the Martian surface and various forms of yellow ochre limonite as previously claimed. Many other substances fit the assumed polarization properties of the Martian surface just as well.
Dissert. Abstr.

N69-17872 Pennsylvania Univ., Philadelphia.
A PHOTOELECTRIC STUDY OF THE VARIABLES BV 544, V701 SCO AND HD 199757
Kam-Ching Leung (Ph.D. Thesis) 1967 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-9216

The Beta Lyrae type eclipsing system BV 544 with a spectral type of A3 was observed on seven nights in 1966. The observations consist of 396 observations in yellow light and 398 observations in blue light. Light elements were improved by means of the method of least squares using all the times of minimum available. The period seems to be constant over the last forty years. The W UMa type eclipsing system, V701 Sco, with a spectral type of B5, was observed on eight nights in 1966. The observations consist of 520 observations in the yellow light and 512 observations in the blue light. The period seems to be constant over the last forty years. The Dwarf Cepheid variable, HD 199757, was observed on four nights. There were 165 observations in yellow light, 175 observations in blue light and 51 observations in ultra-violet light.
Dissert. Abstr.

N69-17912*# National Aeronautics and Space Administration, Washington, D. C.
APOLLO 8: MAN AROUND THE MOON
[1969] 26 p
(NASA-EP-66) Avail: SOD $0.50; CFSTI CSCL 22A

This illustrated booklet on the Apollo 8 flight around the moon follows the three astronauts from the moment they enter the capsule until spacecraft splashdown and recovery. Included are several photographs of lunar and Earth surfaces taken by the space crew during the actual flight.
G.G.

N69-17915 Wisconsin Univ., Madison.
THERMODYNAMIC PROPERTIES OF PARTIALLY DEGENERATE, SEMI-RELATIVISTIC IDEAL GASES AND APPLICATION TO THE EQUILIBRIUM STRUCTURE OF RED GIANTS OF POPULATION II
Terry Winslow Edwards (Ph.D. Thesis) 1968 524 p
Avail: Univ. Microfilms: HC $23.65/Microfilm $6.65 Order No. 68-7098

The theory of the equations of state and related thermodynamic properties of ensembles of weakly interacting particles is reviewed. Both quantum degenerate and special relativistic effects are considered. The equations of state and related thermodynamic properties such as the entropy and specific heats are given in parametric integral form and are shown to asymptotically approach known forms in several limiting cases. Numerical tables of the parametric integrals and of the equations of state and related thermodynamic properties are given for the case of the particles being electrons. The extent of these tables are chosen so as to adequately supplement the indicated asymptotic forms in those regions where the asymptotic forms are slowly convergent.
Dissert. Abstr.

N69-17935*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ROCKET SPECTROGRAPHIC OBSERVATIONS OF α VIR
Andrew M. Smith Nov. 1968 21 p refs
(NASA-TM-X-63402; X-613-68-430) Avail: CFSTI CSCL 03B

Two spectrograms of α Vir (B1 V) in the wavelength interval 928 Å ≤ λ ≤ 1350 Å and with 0.8 Å resolution were successfully recorded on a rocket flight June 1, 1967. The data revealed hydrogen Lyman absorption lines through L-ζ and in addition, evidence for 128 absorption lines arising from the ground and low lying states in ions of C, N, Si, S, Cl, Ti, V, Cr, and Fe. An empirical flux distribution is derived from the data and compared to the fluxes of a model atmosphere for which Te = 22,600°K and in which the Lyman transitions are the only source of line absorption. The results imply that strong line blanketing occurs at λ < 1350 Å. No interstellar absorption lines due to H_2 were observed; an upper limit for the mean number density of this molecule between the earth and α Vir is 3.1×10^{-4} cm^{-3}.
Author

N69-17969*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
POWER SPECTRA OF THE INTERPLANETARY MAGNETIC FIELD
James W. Sari (Md. Univ., College Park) and Norman F. Ness Dec. 1968 28 p refs
(NASA-TM-X-63428; X-616-68-318) Avail: CFSTI CSCL 03B

Power spectra based on Pioneer 6 interplanetary magnetic field data in early 1966 exhibit a frequency dependence of f^{-2} in the range 2.8×10^{-4} to 1.6×10^{-2} cps for periods of both quiet and disturbed field conditions. Both the shape and power levels of these spectra are found to be due to the presence of directional discontinuities in the microstructure (<0.01 AU) of the interplanetary magnetic field. Power spectra at lower frequencies, in the range of 2.3 ± 10^{-6} to 1.4 ± 10^{-4} cps, reflect the field macrostructure (>0.1 AU) and exhibit a frequency dependence roughly between f^{-1} and $f^{-3/2}$. The results are related to theories of galactic cosmic ray modulation and are found to be consistent with recent observations of the modulation.
Author

N69-17999*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE GODDARD GENERAL ORBIT DETERMINATION SYSTEM
Joseph W. Siry, James P. Murphy, and Isabelle J. Cole May 1968 676 p refs
(NASA-TM-X-63413; X-550-68-218) Avail: CFSTI CSCL 22C

The General Orbit Determination System currently being used for Orbit Determination at the Goddard Space Flight Center has evolved over a period of approximately a decade. It was contemplated, when the system was designed, that it would come to be used to determine orbits of satellites of various kinds, tracked by different types of tracking systems, and moving in many sorts of orbits which would be perturbed in a variety of ways by a atmosphere having variable characteristics and by a gravitational field whose higher harmonics would come into play, as well as by the moon, the sun, and radiation pressure. As the needs arose and the occasions demanded, additional orbit determination capabilities to meet the new circumstances were incorporated into the system in accordance with the basic plans. During this time the program was extended to accept new data types and, at various times, additional sets of unknowns were incorporated into it. The program was also equipped to use several general perturbation and special perturbation orbit theories and has been adapted to operate on various computers. The purpose of this report is to set forth the formulations used in the system. In addition, flowcharts and program listings are also included.
Author

N69-18035 Case Western Reserve Univ., Cleveland, Ohio.
INTERSTELLAR REDDENING IN THE ENVIRONS OF THE SUN
Maurice Pim FitzGerald (Ph.D. Thesis) 1967 249 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 68-10155

The UBV and U_c photometry for 8000 stars listed in the Blanco-FitzGerald catalog has been used to determine new intrinsic colors for MK spectral types, and the equations of the two color reddening lines. A study of the distribution of interstellar dust within a few kiloparsecs of the sun has also been made. A new calibration of absolute magnitude as a function of MK spectral type compatible with the photometric distance moduli of clusters has also been made. Dissert. Abstr.

N69-18107*# Hawaii Inst. of Geophysics, Honolulu.
ADJUSTMENT OF SATELLITE TRIANGULATIONS
R. A. Hirvonen 5 Dec. 1968 24 p ref
(Grant NGR-12-001-045)
(NASA-CR-99493; HIG-68-20) Avail: CFSTI CSCL 22C

The elementary problem considered was: Given earth-fixed space directions from two non-intervisible ground stations A and B to two elevated points 1 and 2, find the direction AB. Since more than two elevated points were to be used in the practice, a preliminary adjustment for each side AB was carried out. As the result of this adjustment, the two correlated quantities S_{AB} and t_{AB}, which were obtained, can be used as fictive observations, in the main adjustment of a network of several stations. If there are N stations, the main adjustment contains 3N parameters. Of these, four cannot be determined by triangulation. It hardly seems worthwhile, however, to include in the main adjustment such observations as satellite distances, ground triangulations, levelings, and astronomical coordinates (with gravimetric deflections of the vertical). It is suggested, therefore, that four other conditions be used, in order to keep the gravity center of all stations and the mean scale of the approximate coordinates fixed. In this way, the overall accuracy obtainable by the adjustment of the network can be estimated. Author

N69-18117 Maryland Univ., College Park.
THE KLEIN-GORDON GEON
David James Kaup (Ph.D. Thesis) 1967 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order 68-6531

A study of the spherically symmetric eigenstates of the Klein–Gordon, Einstein equations, Klein–Gordon geons, reveal that these geons have properties that are uniquely different from other gravitating systems that have been studied. When the question of stability is considered from a thermodynamical viewpoint, it is shown that, unlike other systems, adiabatic perturbations are forbidden. The equations of state for the thermodynamical variables are not algebraic equations, but instead are differential equations; consequently, the usual concept of an equation of state breaks down when Klein–Gordon geons are considered. When the question of stability is reconsidered in terms of infinitesimal perturbations of the basic fields, it is then found that Klein–Gordon geons will not undergo spherically symmetric gravitational collapse. Thus, Klein–Gordon geons are counterexamples to the conjecture that gravitational collapse is inevitable. Dissert. Abstr.

N69-18118 Case Western Reserve Univ., Cleveland, Ohio.
SPACE DISTRIBUTION OF STARS IN THE SOUTHERN MILKY WAY: A REGION IN NORMA
John Scott Drilling (Ph.D. Thesis) 1967 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-10152

The V magnitudes, B–V colors and spectral types have been determined for 1292 stars in LF 15, an area of 20.3 square degrees centered at $1^{II}=330°$, $b^{II}=-2°$. The color excess in LF 15 has been found to rise steadily with distance from the sun to $E_{B-V}=0^m.8$ at 4 kiloparsecs. Space densities of the stars in LF 15 have been computed as a function of spectral type and distance from the sun. The densities of B7-A1 stars between 400 and 1000 parsecs are about twice the density near the sun. A high density of G7-K4 giants is also encountered at 500 parsecs. The space densities of stars of all spectral types have been used to compute the stellar luminosity function in the range $-4 \leq M_v \leq 6$ at 100, 200, 400 and 600 parsecs from the sun. There is an increase in $\Phi(M_v)$ for $M_v > -1$ and a decrease in $\Phi(M_v)$ for $M_v < -1$ with increasing distance from the sun in the direction of LF 15. Dissert. Abstr.

N69-18177# Joint Publications Research Service, Washington, D. C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophy., Astronomy, and Space, No. 196 14 Jan. 1969 p 1–11 refs (See N69-18176 07-34)
Avail: CFSTI

Operational methods and results of 26 year long zenith telescope observations are described. A summary of recent studies on carbon content in meteorites is given. Included are abstracts of various scientific articles that cover planetary atmospheric structures, composition of cosmic plasma, and phenomena of solar atmosphere. G.G.

N69-18183# Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
AN ASPECT OF TERRESTRIAL ENVIRONMENT FOR SPACE VEHICLES: METEOROIDS AND MICROMETEOROIDS [UN ASPECT DE L'ENVIRONNEMENT TERRESTRE POUR LES VEHICULES SPATIAUX: METEORIDES ET MICROMETEORIDES]
J. C. Mandeville Apr. 1968 93 p refs In FRENCH
(CERTS-NT-01-7) Avail: CFSTI

This monograph reports theoretical and experimental studies of the meteoroid environment of spacecraft and exposes the terrestrial and satellite-borne methods for detecting them. ESRO

N69-18217# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
MULTI-IMPULSE, OPTIMAL RENDEZ-VOUS OF MEDIUM DURATION BETWEEN NEAR-CIRCULAR, COPLANAR, CLOSE ORBITS [RENDEZ-VOUS MULTI-IMPULSIONNELS, OPTIMAUX, DE DUREE MOYENNE, ENTRE ORBITES QUASI-CIRCULAIRES, PROCHES, COPLANAIRES]
Jean-Pierre Marec 1968 15 p refs In FRENCH; ENGLISH summary Presented at the 19th Intern. Astronautical Congr., N.Y., 13–19 Oct. 1968
(ONERA-TP-609) Avail: CFSTI

The analytical solution presented in this study can be used in the case of an optimal rendez-vous (minimum fuel consumption for a thrustor capable of delivering impulses) between close orbits of small eccentricity, when these orbits are coplanar, or, what is more realistic, when the propulsion system allows the uncoupling between the problems of the orientation of the orbital plane and of the in-plane rendez-vous (thrustor(s) producing a thrust normal to the orbital plane, associated with a normal thrustor producing a freely orientable thrust in the orbital plane). The solution is only valid for rendez-vous of sufficient duration: the relative error on the consumption is of the order of the inverse of the square of the transfer angle. The zones of the reachable domain for a given consumption (in the space of the variations of the orbital elements) corresponding to the different types of optimal solutions (number of impulses ≤ 4, initial and (or) final coasting periods etc ...) are studied in detail. ESRO

N69-18250# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
ANALYTICAL COMPARISON OF THE SUCCESSIVE PLANETARY WINDOWS IN THE STUDY OF THE ECONOMICAL EARTH-PLANET TRANSFERS
Christian Marchal 1968 6 p refs Presented at the 19th Intern. Congr. of Astronautics, N.Y., 13–19 Oct. 1968 Submitted for publication
(ONERA-TP-810) Avail: CFSTI

The analytical study of the economical interplanetary transfers (from the point of view of the characteristic velocity), in the real planetary cases and in the vicinity of the theoretical Hohmann solutions, leads to two types of optimal transfers: the transfers 'without intermediate thrust phase' (optimal for Earth-Mars and Earth-Venus) and the transfers 'with an intermediate thrust phase' (optimal for Earth-Mercury). The differences with the Hohmann solutions are very important; they are mainly due to the inclinations of the orbits and, in a lower proportion, to the eccentricities. Author (ESRO)

N69-18264# Centre National d'Etudes Spatiales, Paris (France).
THEORY AND DETERMINATION OF EARTH ARTIFICIAL SATELLITE ORBIT [THEORIE ET DETERMINATION PRATIQUE DE L'ORBITE D'UN SATELLITE ARTIFICIEL DE LA TERRE]
J.-C. Blaive 1968 40 p In FRENCH Presented at the CNES Symp. on Space Technol., Bretigny, France, 12 Mar.–2 Apr. 1968
Avail: CFSTI

A broad outline of the calculation of the orbit of an artificial earth satellite is given, together with an account of the perturbation forces acting on it. Tracking methods are listed and the radio interferometric method is summarized. The computation of the orbital elements from interferometric data is discussed.

N69-18295# Smithsonian Astrophysical Observatory, Cambridge, Mass.
OPTICAL STUDIES OF FLARE STARS IN CONJUNCTION WITH SIMULTANEOUS RADIO-FREQUENCY OBSERVATIONS OF THE SAME STARS Final Report, 1 Sep. 1968–31 Aug. 1968
Robert W. Martin Nov. 1968 17 p
(Contract N00014-67-C-0161)
(AD-679178; SAO-811-40) Avail: CFSTI CSCL 3/2

This paper gives optical data, taken in a one year program of flare star photography in conjunction with radio-frequency observations by cooperating universities. The data is reduced to light curves for meaningful comparison and analysis with radio data. TAB

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-17286# Technische Univ., Berlin (West Germany). Lehrstuhl und Institut fuer Raumfahrttechnik.
REUSABLE TRANSPORTATION SYSTEM: NEPTUN, GRAVITY CENTER CALCULATION [WIEDERVERNENDBARES TRAEGERSYSTEM: NEPTUN-SCHWERPUNKTSRECHNUNG]
Paul-Dieter Dohmoehl Apr. 1968 14 p In GERMAN; ENGLISH Summary
(TUB-IR-1968/10) Avail: CFSTI

The following report gives a survey on the position of the different NEPTUN gravity centers during the whole operational turn-around of the transportation system. Since the NEPTUN system is in constant development it must be said, that this investigation is related to the NEPTUN configuration of April 1968. Author

N69-17287# Technische Univ., Berlin (West Germany). Lehrstuhl und Institut fuer Raumfahrttechnik.
REUSABLE TRANSPORTATION SYSTEM: COLLECTION OF EXAMPLES FOR THE DEVELOPMENT STORY OF THE REUSABLE TRANSPORT SYSTEM NEPTUN [WIEDERVERWENDBARES TRAEGERSYSTEM: BEISPIELSAMMLUNG ZUR ENTWICKLUNGSGESCHICHTE PES WIEDERVERWENDBAREN TRAEGERSYSTEMS NEPTUN]
Eckart Elsner 1968 44 p refs In GERMAN; ENGLISH summary
(TUB-IR-1968/12) Avail: CFSTI

Milestones of the development of a large reusable space transportation system called NEPTUN are outlined in a series of drawings with a short text, showing the change and improvement of the configuration, starting with the American 1960 SEA DRAGON-concept up to the NEPTUN of 1968. Author

N69-17433# Technische Univ., Berlin (West Germany). Lehrstuhl und Inst. fuer Raumfahrttechnik.
REUSABLE TRANSPORT SYSTEM: AERODYNAMIC HEATING OF THE NEPTUN STAGES DURING ASCENT AND DESCENT [WIEDERVERWENDBARES TRAEGERSYSTEM: ZUR AERODYNAMISCHEN ERWAERMUNG DER NEPTUN-STUFEN BEIM AUF-UND ABSTIEG]
H.-Klaus Petrick Jul. 1968 56 p refs In GERMAN; ENGLISH summary
(TUB-IR-1968/11) Avail: CFSTI

During ascent of the reuseable two stage rocket "NEPTUN" and during descent of the stages, the outer structures will undergo an aerodynamic heating. The shape of the rocket is reduced to simple geometric shapes. The formulas for the determination of the convective heating are specified, and computer program is explained, which is able to compute the wall temperatures and heating rates depending on the steps of a given trajectory. An extensive study of the parameters is then carried out and the results are plotted graphically. Author

N69-17436# Technische Univ., Berlin (West Germany). Lehrstuhl und Inst. fuer Raumfahrttechnik.
REUSABLE TRANSPORT SYSTEM: NEPTUN MASS-MODEL [NIEDERVERWENDBARES TRAEGERSYSTEM: NEPTUN MASSENMODELL]
Manfred Birreck [1968] 89 p refs In GERMAN; ENGLISH summary
(TUB-IR-1968/7) Avail: CFSTI

In the present paper, the model for mass calculation is explained in detail. Especially the methods used for calculating the structure and the flap-optimization are presented. Furthermore the complete list of the computer program, as well as several outputs of the same are given. Author

N69-17437# Technische Univ., Berlin (West Germany). Lehrstuhl und Inst. fuer Raumfahrttechnik.
REUSABLE TRANSPORT SYSTEM: CONSTRUCTIVE DESIGN AND WEIGHT ESTIMATION OF THE PLUG-NOZZLE SKIN ON THE SECOND STEP OF THE TRANSPORT SYSTEM NEPTUN [WIEDERVERWENDBARES

TRAEGERSYSTEM: EIN BEITRAG ZUR KONSTRUKTIVEN GESTALTUNG UND ZUR GEWICHTSABSCHAETZUNG DER HAUTSTRUKTUR AN DER PILZ-DUESE DER ZWEITEN STUFE DES TRAEGERSYSTEMS NEPTUN]
Juergen Allesch [1968] 59 p refs In GERMAN; ENGLISH summary
(TUB-IR-1968/6) Avail: CFSTI

A mass estimate was performed for plug-nozzle skin and skin structure of the large reusable space transportation system, called NEPTUN. Because NEPTUN has the concept of "controlled simplicity" the construction is not too complex. Basically it consists of a skin connected to a system of frameworks. For the design a Computer Program was written which allows the input of all essential loads and structure materials. The most optimal system was determined considering costs, weight, and different booster sizes. Author

N69-17486# Technische Univ., Berlin (West Germany). Lehrstuhl und Inst. fuer Raumfahrttechnik.
REUSABLE TRANSPORT SYSTEM: MASS EVALUATION OF THE NEPTUN PRESSURIZATION SYSTEM [WIEDERVERWENDBARES TRAEGERSYSTEM: MASSEN-ABSCHAETZUNG DES NEPTUN-DRUCKGASSYSTEMS]
Eckart Elsner [1968] 24 p refs In GERMAN; ENGLISH summary
(TUB-IR-1968/9) Avail: CFSTI

In the reusable space transportation rocket Neptun the gases of the pressurization system are partially stored in the "columns" of the inner structure and partially in pressure-gas-balls within the oxygen tanks. To give the pressurization system a better effectiveness and to reduce the necessary volumes for storage, the gases are heated before entering the tanks. This report gives a look at the weight estimate of the Neptun pressurization system. Author

N69-17532# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NUMERICAL SIMULATION OF THE ATTITUDE EQUATIONS OF A SATELLITE CONTAINING DAMPING ROTORS AND A REACTION WHEEL
Roger W. Brockett and Naomi M. Brody Nov. 1968 48 p refs
(Contract AF 19(628)-5167)
(AD-679992; TN-1968-24; ESD-TR-68-352) Avail: CFSTI CSCL 22/2

This report describes a program for simulating the motion of a rigid body containing a reaction wheel, damping media and torquing (magnetic or otherwise). The dynamical equations are simulated in terms of the angular velocities in body-fixed coordinates and the kinematic equations are simulated in terms of direction cosines. The entire system of equations has been programmed using a fourth order predictor-corrector method with automatic step-size adjustment and a fourth order Runge-Kutta starting routine. The ratio of computer time to real time is between 1 to 10 and 2 to 1 for LES-5-type satellites. Author (TAB)

N69-17572# Illinois Univ., Urbana. Coordinated Science Lab.
SPACECRAFT ATTITUDE CONTROL USING FEEDBACK PARAMETER OPTIMIZATION
George Charles Schumacher Oct. 1968 49 p refs
(Contract DAAB07-67-C-0199)
(AD-679875; R-394) Avail: CFSTI CSCL 22/2

The type of control system to be designed is highly dependent upon the vehicle configuration and the mission functions. In cases where high pointing accuracy is required an active control system is necessary. This system consists of some attitude sensing device, a torque producing device, and the associated electronics. This paper is primarily concerned with the design of an active control system for holding the desired vehicle angular rates during small disturbances. Author (TAB)

N69-17695*# Martin Co., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF MATHEMATICAL MODEL(S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 1: TECHNICAL REPORT Final Report
R. F. Meuser and B. A. Nelson 1968 84 p Prepared for JPL
(Contracts NAS7-100; JPL-952028)
(NASA-CR-73856; MCR-68-97-Vol-1) Avail: CFSTI CSCL 22B

A mathematical simulation model and associated computer programs were developed to predict the accumulation of microbial burden at any point during the assembly and test of any spacecraft. The model is flexible in that it may be used to simulate the assembly and test of any spacecraft. During this program, a Voyager type capsule bus system was simulated. The model provided the capability to analyze assembly and test operations in terms of discrete procedural steps. The model provided the capability to partition the spacecraft into zones and to predict the accumulation of burden on these zones. The level of detail represented in the model made it possible to establish a 1:1 relationship between assembly and test operations and the sources of burden accumulation. The burden prediction technique consisted of mathematical expressions that represent known burden accumulation mechanisms. The model used the interval concept to represent and manipulate burden probability distributions. Data inputs to the model were defined and arranged to provide flexibility and visibility. Data output was provided describing detailed results of the simulation. Author

N69-17696*# Martin Co., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF MATHEMATICAL MODEL(S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 2: USER'S MANUAL FOR THE MICROBIAL BURDEN PREDICTION PROGRAM Final Report
P. B. McKowen Dec. 1968 115 p Prepared for JPL
(Contracts NAS7-100; JPL-952028)
(NASA-CR-73855; MCR-68-97-Vol-2) Avail: CFSTI CSCL 22B

The capabilities, logical approach, data inputs, and deck arrangements for the microbial burden prediction model computer program are described. The program, written in FORTRAN IV for the IBM 7094, is a highly versatile program for simulating the gain and loss of biota on the various surfaces of a spacecraft system during the steps of assembly, test, transport, decontamination, etc., associated with its preparation. Three accumulation mechanisms were developed, any combination of which can be used at any step by specifying appropriate input values for the comprehensive set of coefficients, modifiers, and histogram points. Effective use of the program depends on an understanding of the program logic, the mathematical models involved, and of the significance of the input quantities. Author

N69-17697*# Martin Co., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF MATHEMATICAL MODEL(S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 3: APPENDICES Final Report
R. F. Meuser Dec. 1968 164 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952028)
(NASA-CR-73840; MCR-68-97-Vol-3) Avail: CFSTI CSCL 22B

Assumptions made during the development of the burden prediction model are summarized. A bibliography of reference documents used in the study are listed. Summary results of all functional analyses performed on the capsule bus system are presented in tabular form and in flow charts. Two sections are involved: operational analyses for the first and second levels flight

capsule assembly and test and all four levels of activity which must be performed to assemble and test the capsule bus system. B.P.

N69-17698*# Martin Co., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF MATHEMATICAL MODEL(S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 4: TECHNICAL REPORT Final Report
B. A. Nelson Dec. 1968 63 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952028)
(NASA-CR-73854; MCR-68-97-Vol-4) Avail: CFSTI CSCL 22B

An attempt was made to obtain accurate values for parameters used in the microbial burden prediction model. These parameters were needed for the burden predictions to be performed for the Mariner Venus 67 Number 2 spacecraft (MV 67). Input data histograms were prepared based on the microbiological assay records for the MV 67. A simulation of the planned assembly and test sequence was made as specified in previous instructions. Activities were organized into stages, tasks, subtasks, and operations as required for model inputs. Each subtask was composed of a combination of 17 generic operations identified in the assembly and test sequence. Burden predictions were made of all parts and compared with the prediction calculated in phase 6. In phase 6, the burden prediction was based on the actual assembly and test sequence of the MV 67. Separate predictions were made for vegetative organisms and for spores. Mean values of the burden predictions are tabulated. B.P.

N69-17699*# Martin Co., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF MATHEMATICAL MODEL(S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 5: APPENDICES Final Report
R. F. Mauser Dec. 1968 248 p Prepared for JPL
(Contracts NAS7-100; JPL-952028)
(NASA-CR-73857; MCR-68-97-Vol-5) Avail: CFSTI CSCL 22B

Appendix 1 lists input data prepared for the phase 5 simulation of the Mariner Venus 67-2 spacecraft assembly and test. Appendix 2 lists input data prepared for the phase 6 simulation. Each listing represents a complete description of all spacecraft assembly and test activities required to build the spacecraft. The data describes activity at each of four levels, the stage, task, subtask and operation. In addition, for each operation performed, the hardware being manipulated is identified. Author

N69-17704# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WHERE IS THE DANGER HIDDEN (?)
Yuri Marinin 25 Jan. 1968 6 p Transl. into ENGLISH from Turkm. Iskra (USSR), no. 29, 3 Feb. 1967 p 3
(AD-679690; FTD-HT-23-1184-67) Avail: CFSTI CSCL 22/2

After describing various aspects of the US space program, it is stated that there apparently occurred a breakdown in the electrical system followed by the burning of the wires; then there was a sudden flash in the early finding of the cause, since it is a very complex problem. If it is only chance that saved the Mercury and Gemini spacecraft from fire, it will be necessary to abandon the use of an oxygen atmosphere in the Apollo spacecraft. This would necessitate the radial modification of the spacecraft, which would require, without any exaggeration, several years. It may turn out that the oxygen atmosphere was not at fault, in which case it will only be necessary to correct the defect. Author (TAB)

N69-17705*# TRW Systems Group, Redondo Beach, Calif.
REACTION CONTROL SYSTEM INTEGRATED SYSTEMS PERFORMANCE ANALYSIS: LM COMPUTER PROGRAM USER'S MANUAL
C. C. Garza, Jr. 30 Aug. 1968 286 p refs
(Contract NAS9-8166)
(NASA-CR-92451; TRW-11176-H028-R0-00) Avail: CFSTI CSCL 22C

A basic functional knowledge of the LM-RCS and its associated subsystem interfaces is assumed. The RCS ISPALM program performs those duties of data acquisition and mathematical calculations required for a realistic evaluation of the RCS. The program was designed for ease of operation and modification in order to extend its usefulness as an engineering tool when used in reducing manual effort in the LM flight evaluation process. The program is subdivided functionally into two areas: data acquisition and engineering calculations. The data acquisition portion of the program selects and processes data specified by user input and places the specified processed data values in a data bank for engineering use. The engineering section takes this data, calculates specified results and outputs them. A functional description of the engineering formulation is presented next, and the data acquisition and program operations are described following the formulations. Author

N69-17731*# Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
DETAIL SPECIFICATION SURVEYOR SYSTEM FUNCTIONAL REQUIREMENTS, REVISION H
7 Mar. 1967 185 p refs Prepared for JPL Revised
(Contract NAS7-100)
(NASA-CR-73865; Rept-224510-Rev-H) Avail: CFSTI CSCL 22B

This specification, in conjunction with the Surveyor Spacecraft System Design Specification and the Surveyor Scientific Instrument Interface Specifications, serves to define completely the system functional requirements on the Surveyor spacecraft system including the spacecraft ground equipment, trajectory, prelaunch, launch, and injection requirements. This specification has both the purpose and the authority to define system and subsystem functional performance requirements which, in turn, are to be considered as requirements in the writing of equipment (control item) specifications. Whereas the Design Specification and the Interface Specifications are contractual documents, this specification is an internal working document. If there is any conflict between this document and the above contractual documents, the most stringent requirements shall apply. Author

N69-17801*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE DETERMINATION OF A STABILITY INDICATIVE FUNCTION FOR LINEAR SYSTEMS WITH MULTIPLE DELAYS
John D. Shaughnessy and Yasutada Kashiwagi (Stanford Res. Inst., Menlo Park, Calif.) Washington Feb. 1969 35 p refs
(NASA-TR-R-301) Avail: CFSTI CSCL 12A

A theoretical study is made of the stability of a class of linear differential-difference equations with multiple delays. A direct method for determining the exact stability boundaries for homogeneous, linear differential-difference equations with constant coefficients and constant delays is formulated. This formulation results in a stability indicative function, depending on a single parameter, which determines the number of roots of the transcendental characteristic equation that have positive real parts. It is proved that the system is stable if and only if this function has a value of zero. A second-order system with delays in the velocity and position feedback terms is considered as an example, the stability regions for this system are determined for a range of

delays and coefficients. It is observed that introduction of a delay has a definite destabilizing effect on the system, and introduction of a second delay has a compounding effect to further reduce stability. However, this example clearly illustrates that certain combinations of delays can stabilize an unstable system. This phenomenon is discussed from a theoretical point of view. Author

N69-17842 *# General Dynamics/Convair, San Diego, Calif.
EVALUATION AND APPLICATION OF DATA FROM LOW-GRAVITY ORBITAL EXPERIMENT Quarterly Progress Report, 20 May-20 Aug. 1968
27 Sep. 1968 44 p refs
(Contract NAS8-21291)
(NASA-CR-98270; Rept-584-4-214; QPR-2) Avail: CFSTI CSCL 22A

A discussion of analytical work in the areas of repressurization, thermal energy evaluation, tank pressure rise, liquid level rise, and dynamics of sloshing, is presented. Valid modeling of the repressurization period of flight involves specifying of several variables. These include a time-dependent helium input thermodynamic state, the thermodynamic interactions of the recirculation flow, and the tank wall thermal energy input. These variables are being investigated; some difficulty has occurred in the thermal modeling of the S-4B forward bulkhead area. The evaluation of the pressure rise during the fourth orbit closed tank experiment has also been complicated by difficulty in defining the thermal energy input through the forward bulkhead. A mathematical formulation has been developed to evaluate the change in liquid level weight during a rapid vent down. A discussion is given of the previous models for this event and their shortcomings. The application of the pendulum analogy for slosh simulation of model drop tower tests is discussed. Author

N69-17851 *# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NIMBUS 2 FLIGHT EVALUATION AND ENGINEERING REPORT, LAUNCH THROUGH ORBIT 5275
Joseph J. McNaney (GE), Bennie A. Palmer (GE), and Ralph Shapiro Washington Feb. 1969 197 p refs
(NASA-TN-D-4881) Avail: CFSTI CSCL 22A

This report covers the flight history of Nimbus 2 from its launch on May 15, 1966, through orbit 5275 on June 15, 1967, providing an engineering evaluation of the performance during this period. The mission successfully met all technological and scientific objectives, the only failures being the tape recorders, PCM., MRIR, AVCS, and HRIR; these failures occurred during orbits 949, 985, 1443, and 2455, respectively. As of March 15, 1968 (22 months, orbit 9020), the spacecraft was performing satisfactorily with little change in performance since June 15, 1967, except for the solar array drive. After October 1967, the drive system evidenced occasional erratic behavior and since then has been operated in the high-torque mode. The real time data systems are still being used. Author

N69-17864 *# Communication Systems, Inc., Falls Church, Va.
PROCEEDINGS OF THE GEOS PROGRAM REVIEW MEETING. VOLUME 1: GEOS-1 OPERATIONS AND PLANS FOR GEOS-B
Mar. 1968 226 p refs Proc. held in Washington, 12-14 Dec. 1967
(Contract NASw-1503)
(NASA-CR-73958) Avail: CFSTI CSCL 22B

Papers are presented on the tracking and data acquisition and processing operations for the satellites. The exact positioning of the stations, and radar and laser participation, and the range and range rate data are described. The GEOS 1 performance, and data processing and data center operations are covered. A description of GEOS B is given and the launch windows are indicated. Emphasis is placed on the various geodetic experiments and the anticipated results. N.E.N.

N69-17888 *# Texas Instruments, Inc., Dallas. Equipment Group.
FEASIBILITY STUDY OF A SPACECRAFT MOUNTED METEOROID RADAR SYSTEM. VOLUME 1: RESULTS OF THE ANALYTICAL STUDY Final Technical Report
Dec. 1968 238 p
(Contract NAS9-7822)
(NASA-CR-92481; U1-943500-1-Vol-1) Avail: CFSTI CSCL 17I

This study investigated the feasibility of employing a radar mounted on an interplanetary spacecraft to detect and measure characterizing parameters for meteoroid data having particle sizes in the one millimeter to one meter range. The study goals specified for the radar were (1) detection and measurement of 1000 particles in a one-year period of operation, (2) particle characterizing measurements were to be designed to have an accuracy of 10 percent of the measured parameter value, and (3) a state of the art radar concept was to be developed for these purposes which was to be used on a Mariner or Voyager type spacecraft for missions to Mars or the asteroid belt. Volume 1 reports the analytical and tradeoff studies performed in first determining and then optimizing the detection and measurement capabilities of a radar system. Author

N69-17889 *# Texas Instruments, Inc., Dallas. Equipment Group.
FEASIBILITY STUDY OF A SPACECRAFT MOUNTED METEOROID RADAR SYSTEM. VOLUME 2: SYSTEM IMPLEMENTATION Final Technical Report
Dec. 1968 63 p
(Contract NAS9-7822)
(NASA-CR-92482; U1-943500-1-Vol-2) Avail: CFSTI CSCL 17I

Volume 1 of this report discusses the detection and measurement capabilities of several candidate meteoroid radar systems. A particular type of radar was selected for further detailed study and the radar parameters were selected so as to maximize the number of particles detected consistent with physical limitations imposed by the space environment. The optimum design was then modified to provide velocity and radar cross section measurement capabilities. This volume is an addendum to the analytical analysis performed in Volume 1. Presented is a sample and suggested radar system design based upon the optimum system as determined by the results reported in Volume 1. Attention has been focused on the asteroid belt fly-through mission, because of the large detection advantage resulting from this choice. The radar discussed is a noncoherent pulsed radar employing a pair of nontracking, frequency-scanned pencil beams for making velocity measurements. The nominal design parameters of the radar system selected for detailed design are presented. Author

N69-17892 *# Communications and Systems, Inc., Falls Church, Va.
A PERFORMANCE EVALUATION OF GEOS-2
Robert E. Dwyer Sep. 1968 45 p refs
(Contract NASw-1503)
(NASA-CR-99331; R-4035-46-1) Avail: CFSTI CSCL 22A

This report documents the activities involved in the implementation of the GEOS-2 operation, discusses the operational performance of the ground elements and describes the in-orbit performance of each spacecraft and geodetic system. Performance data are presented for the period from launch through 31 July 1968. Author

N69-17946*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLIGHT PROJECTS Technical Report, 1 Sep.–31 Oct. 1968
30 Nov. 1968 57 p *Its* Space Programs Summary 37-54, vol. 1
(Contract NAS7-100)
(NASA-CR-73958) Avail: CFSTI CSCL 22B

This report describes progress in the Mariner Mars 1969 project, covering the following: (1) a brief mission description and status of the project; (2) launch vehicle integration and spacecraft system tests and operation; (3) systems analyses of trajectories, accuracy, TV coverage, data processing, and mission operations; (4) engineering mechanics work on cabling subsystem, TV camera assembly, and heat pipes for the radio power amplifier; (5) attitude control and gas nozzles for control torque; (6) antenna assembly and flight command telecommunications; and (7) design and performance of the infrared and ultraviolet spectrometers. K.W.

N69-18181# Joint Publications Research Service, Washington, D. C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 196 14 Jan. 1969 p 73-91 refs (See N69-18176 07-34)
Avail: CFSTI

Launch windows for several Cosmos satellites are briefly described. Lectures at a conference on ionospheric radio wave absorption deal with a variety of experimental observations on electron distribution characteristics in the various earth atmosphere layers and its effects on radio wave propagation. Attached scientific abstracts focus on studies of solar cycle effects, meteorites, and satellite orbital elements. G.G.

N69-18186# European Space Research Organization, Paris (France).
HEOS A
1968 34 p
Avail: CFSTI

The HEOS-A spacecraft, the first European satellite intended for exploration of interplanetary space far beyond the vicinity of the earth, and the third scientific satellite launched by ESRO is described in terms of the history of the project, orbit and launch conditions and spacecraft design. The scientific mission is summarized and the onboard experiment for measurements on magnetic fields, solar wind and solar and galactic cosmic rays are enumerated. Author (ESRO)

N69-18199# Technische Univ., Berlin (West Germany). Lehrstuhl und Institut fuer Raumfahrttechnik.
DEVELOPMENT CRITERIA FOR LARGE REUSABLE TRANSPORTATION SYSTEMS Interim Report [ENTWURF-SKRITERIEN FUER GROSSE WIEDERVERWENDBARE TRAEGERSYSTEME]
H. H. Koelle and E. Elsner Oct. 1968 27 p refs In GERMAN; ENGLISH summary
(TUB-IR-1968/17; IR-3) Avail: CFSTI

This is a status report about the research concerning big, reusable space transportation systems. Preliminary considerations for a system called NEPTUN are presented, including structural ideas, propulsion possibilities, aerodynamics, payload, assembly, and ground support. K.W.

N69-18208# Saab Aircraft Co., Linkoping (Sweden). Gothenburg Electronics Lab.
A DIRECT DIGITAL ATTITUDE CONTROL SCHEME FOR ASTRONOMIC SATELLITES
B. Schmidtbauer [1968] 24 p refs Presented at the CNES Intern. Colloq. on Satellite Attitude and Stabilization, Bretigny, France, 8–11 Oct. 1968
Avail: CFSTI

A presentation is made of a high performance attitude control system, where a digital computer is used for all control calculations between sensor inputs and actuator commands (Direct Digital Control). Through a digital filtering technique of the recurrence type, involving a mathematical model of the dynamical system, the bandwidth requirements upon the sensor signals are minimized, allowing acceptable operation under severe measurement disturbance conditions. The processing technique, in essence, establishes a short term inertial attitude reference, where the measurements are used for long term updating. ESRO

N69-18249# Louvain Univ. (Belgium). Inst. de Mécanique et Mathématiques Appliquées.
ATTITUDE STABILITY OF DEFORMABLE SATELLITES
P. Y. Willems [1968] 34 p refs Presented at the CNES Intern. Conf. on Attitude Evolution and Satellite Stabilization, Paris, 8–11 Oct. 1968 Sponsored jointly by NASA and ESRO
(NASA-CR-99486) Avail: CFSTI

A general formulation for the dynamics of deformable bodies is derived. The attitude stability of deformable earth-pointing satellites is investigated in a general form and simple stability criteria are obtained. Author (ESRO)

N69-18269# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
POSSIBLE LANDING ZONE FOR AN ORBITAL REENTRY GLIDER [DOMAINE ACCESSIBLE AU SOL PAR UN PLANEUR ORBITAL RENTRANT DANS L'ATMOSPHERE]
Jean Fave 1968 12 p refs In FRENCH; ENGLISH summary
Presented at the 6th Intern. Congr. of Aeron. Sci., Munich, 9–13 Sep. 1968 Submitted for publication
(ONERA-TP-607) Avail: CFSTI

The modulation of the angle-of-attack and of the bank angle enables an orbital re-entry glider to reach any point within a set of points which forms a footprint on the ground. Optimal paths leading to points located on the boundary of this footprint are obtained by using a modified gradient method from which can be defined the control laws, even along the less sensitive arcs. A parametric study shows that the maximum lateral range is strongly dependent upon the lift-to-drag ratio, and slightly dependent upon the ballistic coefficient and the characteristics of the re-entry orbit. This optimization provides a 15% improvement with respect to the approximate analytical results. Two complete footprints are drawn with two wing-load values, for a 1.0 lift-to-drag ratio glider and their limitations due to heat constraints are indicated. A maximum heating rate constraint (for a re-radiating structure) leads to a small decrease of the reachable domain on the ground, for low wing-load gliders only. Author (ESRO)

N69-18282# European Space Operations Center, Darmstadt (West Germany). Control Centre Dept.
ESOC/ESTRACK OPERATIONS PLAN FOR HEOS-A, VOLUME 1
I. Rodger ed. Oct. 1968 100 p
Avail: CFSTI

An overall brief description of the spacecraft and related operational support are provided. The general organization of the project is described in terms of operational organigram, launch system, spacecraft structure, data acquisition, and tracking networks ESRO

N69-18283# European Space Operations Center, Darmstadt (West Germany). Control Centre Dept.
ESOC/ESTRACK OPERATIONS PLAN FOR HEOS-A, VOLUME 2
P. Beech ed. Oct. 1968 77 p
Avail: CFSTI

The general responsibilities and operations of the HEOS-A satellite within the European Space Operations Center (ESOC) and the Stations during prelaunch, early orbit and routine phases are described. Details of equipment settings and interconnections (at systems level) as well as of communications circuits are given. ESRO

N69-18284# European Space Operations Center, Darmstadt (West Germany). Control Centre Dept.
ESOC/ESTRACK OPERATIONS PLAN FOR HEOS-A, VOLUME 3
P. Beech, ed. Nov. 1968 134 p
(HF-195) Avail: CFSTI

This volume contains operational details concerning the nominal profile, prelaunch checkout of network readiness, checkout of the satellite during the early orbit phase, activation of experiments, routine control operations, data acquisition, calibration of experiments, attitude control, monitoring requirements, and emergency procedures. ESRO

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-17228 Case Western Reserve Univ., Cleveland, Ohio.
STRESS CONCENTRATION EFFECTS ON THE IMPACT BEHAVIOR OF CAST STEEL
Edward J. Breznyak (Ph.D. Thesis) 1967 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-10145

This investigation was concerned with the effect of discontinuities on the impact properties of a low alloy cast AISI 8630 steel and on weldments of cast steel bars. Impact testing was performed in both unnotched tension and unnotched bending on specimens of tensile strength between 80–90,000 psi, 110–120,000 psi, and 130–150,000 psi. Control impact tests were performed on standard Charpy V notch specimens. The influence of various phosphorous and sulfur levels on impact were evaluated. Severe degradation of impact properties were encountered when eutectic, Type II sulfide inclusions were present in the cast steel microstructure. The loss of impact resistance is attributed to the occurrence of a fracture that is partially a low energy intergranular type mixed with a transgranular fracture. Discontinuities were observed to be highly detrimental to the impact properties of the cast material in both bending and tension. Impact ductility and fracture energy in bending are dependant on both the location of the discontinuity and the stress concentration produced by the discontinuity. Dissert. Abstr.

N69-17230# Missouri State Highway Dept.
COMPOSITE BEAM TESTS WITH HIGH STRENGTH BOLT SHEAR CONNECTORS
Lawrence N. Dallam and Jerry Lee Harpster Jan. 1968 81 p refs Sponsored in part by Bureau of Public Roads
(Rept-68-3; PB-180196) CSCL 13M

Six full-scale composite beams using high strenth bolts as shear connectors were tested. Design variables included size of steel beam, geometry of loading, size, number, and spacing of shear connectors and strength and type of concrete. The beams were instrumented to measure deflection, slip, and strain, and were loaded in various cycles to failure. In addition, pushout specimens and standard 6 × 12 test cylinders were cast. After completion of the tests, standard rectangular test coupons were milled from material cut from the ends of the steel beams. The experimental results are presented in the form of load vs. deflection, load vs. end slip, slip distribution, strain distribution, and force per shear connector vs. slip graphs. USGRDR

N69-17235# Institut Franco-Allemand de Recherches, St. Louis (France).
RESULTS OF TENACITY TESTS FOR A VCN 45 Mo TYPE STEEL APPROXIMATELY NiCrMo 18-5) [ERGEBNISSE DER SPRENGZAEHIGKEITSPRUEFUNG FUER EINEN STAHL VCN 45 Mo (APPROXIMATELY 35 NiCrMo 18-5)]
H. Haensel 25 Sep. 1967 12 p refs In GERMAN
(ISL-N-18/67) Avail: CFSTI

Explosive fracture toughness of vanadium-carbon-nickel-molybdenum steel pipes was tested by standardized interior explosive loads. Fracture and deformation limits of the mechanical response established a high degree of fracture resistance in the investigated steel pipes. Transl. by G.G.

N69-17246 Cornell Univ., Ithaca, N. Y.
SCATTERING OF ELASTIC WAVES BY A RIGID SPHEROIDAL INCLUSION AND DYNAMIC STRESS CONCENTRATIONS
Michael Ackman Oien (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-9890

The dynamic stress concentrations associated with the diffraction of a plane compressional wave by a rigid spheroidal inclusion imbedded in an elastic continuum are investigated. The inclusion is assumed to be bonded to the surrounding matrix at the interface and to be movable. The incident wave is assumed to vary harmonically in time and to be propagating along the axis of the inclusion. The solution is obtained by expanding the Lamé displacement potentials in series of spheroidal wave functions. It is shown that the Fourier analysis can be greatly simplified through a reformulation of the boundary conditions. The solutions for limiting cases of wavelength of the incident wave and geometry of the inclusion are discussed. Numerical results are presented for three geometries of the inclusion; a prolate, spherical, and oblate inclusion. Dissert. Abst.

N69-17258*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RATIOS OF STEADY-STATE RESPONSES TO VARIOUS TRANSIENT RESPONSES, BOTH HAVING EQUAL MAXIMUM EXCITATION LEVELS
Richard W. Faison Washington Feb. 1969 35 p refs
(NASA-TN-D-5070) Avail: CFSTI CSCL 20K

Presented are acceleration response ratios as determined by a single-degree-of-freedom system analysis for three types of commonly encountered transient excitations. The transient excitations were (1) a modulated sine wave of half-modulation-period duration, (2) a modulated cosine wave of a quarter-modulation-period duration, and (3) a damped sinusoid. Closed-form solutions for the acceleration responses were obtained

by Laplace transform techniques. The ratio of maximum absolute acceleration response for the transient sinusoid to the maximum absolute acceleration response of a steady-state sinusoid having the same frequency is given. Numerical results are presented as the response ratios for various nondimensional parameters. Author

N69-17274# Institut Franco-Allemand de Recherches, St. Louis (France).
MECHANICAL STRENGTH DETERMINATIONS ON CAST EXPLOSIVE CHARGES OF HEXOGENE/TNT [FESTIGKEITSUNTERSUCHUNGEN AN TRINITROTOLUOL-HEXOGEN-GIESSLINGEN]
W. Kegler 21 Apr. 1967 6 p In GERMAN
(ISL-N-2/67) Avail: CFSTI

Bending strength and shock resistance of cast trinitrotoluene hexogene samples were evaluated. Tested were mixtures of TNT and RDX (25:65) with various additions of RDX fine grain, gelled cellulose nitrate, and powdered asbestos. Results showed that elasticity and shock resistance of all cast samples was very low and not sufficient for use in high powered projectiles. Transl. by G.G.

N69-17275*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CRACK TOUGHNESS CHARACTERISTICS OF SEVERAL ALLOYS FOR USE IN HEAVY SECTIONS OF HIGH SPEED AIRCRAFT
Raymond T. Bubsey and William F. Brown, Jr. Washington Jan. 1969 38 p refs
(NASA-TN-D-4998) Avail: CFSTI CSCL 11F

Plane strain crack toughness K_{Ic} tests were made on four heavy section candidate alloys for high speed aircraft. The data are analyzed by using the plane strain crack-size factor $(K_{Ic}/\sigma_{YS})^2$, where σ_{YS} is the 0.2-percent yield strength. The alloys investigated were maraging 250 grade steel, 9Ni–4Co–30 steel, 300M steel, PH 13-8Mo stainless steel, and titanium 6Al–6V–2Sn. These alloys were supplied in fabricated section sizes which ranged from 1/2-inch (13-mm) plate to 13- by 13-inch (330- by 330-mm) forgings. Single-edge-crack tension specimens were used to study the influence of crack orientation in respect to the fibers and to establish the general influence of section size. Double-edge-crack tension specimens were used to determine the effect of test temperature which varied from −110°F to 650°F. The influence of melting practice on the plane strain crack toughness on maraging 250 grade steel was also investigated. Author

N69-17332# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTS ON THE EFFECTS OF GUIDED EXPLOSIVE BLASTS ON IRON AND STEEL [VERSUCHE UEBER DIE WIRKUNG GERICHTETER DETONATIONS-SCHWADEN AUF EISEN UND STAHL]
W. Kegler 28 Apr. 1967 42 p refs In GERMAN
(ISL-T-13/67) Avail: CFSTI

Various geometric shapes of explosives (circular, cylinders, quadrangles, and spheres) in differing discharge arrangements were used to determine the effects of directed detonation waves on iron and steel. Model experiments and X ray flash photographs showed that in an arrangement where the explosive material and the iron plate formed a hollow cone, detonation waves caused marked indentations on metal plates. Application of this hollow effect in explosions is shown for iron plates and double T beams. Transl. by G.G.

N69-17427 California Univ., Berkeley.
LARGE DEFLECTION ANALYSIS OF PLATES
David William Murray (Ph.D. Thesis) 1967 227 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-10379

A brief introduction to the finite element concept and a formulation of classical large deflection plate equations is presented. A general approach to large deflection problems of elastic structures, based on an equilibrium balance between the resisting forces of the final structural configuration and the applied loads, is discussed. The details of a finite element formulation for large deflection plate problems are developed. This development makes use of the constant strain triangle (CST) for in-plane deformation and the linear curvature compatible triangle with nine degrees of freedom (LCCT-9) for out-of-plane deformations. Results of solutions using this technique are compared with typical solutions achieved by the use of classical plate equations. The concept of geometric stiffness is discussed and formulated so that it is applicable to plate problems. The formulation is applied to solve problems where elastic plates with varying support conditions are loaded into post-buckling configurations. The formulation of the plate problem for nonlinear material properties is discussed and an approximate method is developed. Examples of its application are presented. Dissert. Abstr.

N69-17459# Illinois Univ., Urbana. Coordinated Science Lab.
TABLES OF HERTZIAN CONTACT-STRESS COEFFICIENTS
D. H. Cooper Aug. 1968 37 p refs
(Contract DAAB07-67-C-0199)
(AD-679949; R-387) Avail: CFSTI CSCL 20/11

Formulations are given for the coefficients lambda, mu, nu defined by H. Hertz in terms of the solution of a transcendental equation involving elliptic integrals and used by him to describe the deformation of bodies subjected to contact stresses. Methods of approximate calculation are explained, errors in the tables prepared by Hertz are noted. For the purpose of providing a more extensive and more accurate tabulation, using an automatic digital computer, these coefficients are reformulated so that a large part of the variation is expressed by means of easily-interpreted elementary formulas. The remainder of the variation is tabulated to 6 places for 100 values of the argument. Graphs of the coefficients are also provided. Author (TAB)

N69-17460# Tufts Univ., Boston, Mass. Dept. of Civil Engineering.
SIMPLE INSTABILITY MECHANISMS FOR DYNAMIC LOADING Final Report, 1 Oct. 1966–31 Jan. 1968
Samuel Sutcliffe 7 Mar. 1968 55 p refs
(Contract F19628-67-C-0114)
(AD-679767; AFCRL-68-0245) Avail: CFSTI CSCL 20/11

An experimental investigation was undertaken of the potential of certain elastic instability mechaniams in the generating of low rise-time direct and torsional force pulses. Direct pulses were produced by the coupled flexural-axial response of a supercritically loaded column. The behavior of the system was correlated with analysis, and a system designed to operate in the range of rise-times of 10 microseconds to 50 microseconds. Torsional pulses were produced by the application of a dynamic axial surcharge load to a statically buckled twist buckling element. The system was found to produce a combined axial and torsional output, each having the same shape as the input pulse. A peak torque of 12 inch-pounds and rise-times of less than 90 microseconds were observed. Author (TAB)

N69-17549# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EQUATIONS OF THE CYCLICALLY SYMMETRICAL HEAT-STRESSED STATE OF SHELLS OF REVOLUTION OF VARIABLE RIGIDITY
Ya. M. Grigorenko 16 Apr. 1968 13 p refs Transl. into ENGLISH from Teplovye Napryazheniya v Elementakh Konstrukt. (USSR), no. 5, 1965 p 146–156
(AD-679513; FTD-HT-23-263-68) Avail: CFSTI CSCL 20/11

The author considers the strain of closed elastic shells of revolution with rigidity varying along the meridian under the action of a surface load and nonuniform heating, the shells being assumed to be cyclically symmetrical. On the basis of the linear theory for the kth harmonic ($k = or > 2$), the differential equations of the problem are proposed in the form of a normal eighth-order system of the kind $dy/ds = Ay + f$, where y(s) is a vector containing four static and four strain resolving functions; f(s) is a vector, the eight components of which depend on the load and the temperature field; A(s) is a matrix of order 8 x 8, s is the meridional coordinate. Expressions are given for the elements of A and the components of f. The components of the displacements are presented in algebraic form in terms of the strain functions occurring in y, and it is shown how the kinematic boundary conditions may be expressed in terms of the latter. TAB

N69-17553# Wisconsin Univ., Madison. Mathematics Research Center.
APPLICATIONS OF ABEL TRANSFORMS TO THE NUMERICAL SOLUTION OF PROBLEMS IN ELECTROSTATICS AND ELASTICITY
Peter Linz Nov. 1967 78 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679490; MRC-TSR-826) Avail: CFSTI CSCL 12/1

Abel transforms are used to reduce equations arising in connection with certain axisymmetric mixed boundary value problems to a set of integral equations which can be solved numerically. A typical problem is the determination of stresses for the indentation of an elastic medium by a rough punch. Author (TAB)

N69-17566# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
WELDMENT EVALUATION METHODS
J. J. Vagi, R. P. Meister, and M. D. Randall Aug. 1968 75 p refs
(Contract F33615-68-C-1325)
(AD-679987; DMIC-244) Avail: CFSTI CSCL 13/8

The report discusses the specimens and test methods used for the evaluation of weldments by destructive means. Tests described include tension, shear, bend, fatigue, cracking susceptibility, notch toughness, fracture toughness, stress rupture, creep, soundness, and hardness tests. Specimens and test methods are described through the use of 92 illustrations plus standard information applying to each illustration as follows: Purpose of test, number of specimens tested, important variables, data obtained, specifications, references, and remarks. Author (TAB)

N69-17594# Naval Research Lab., Washington, D. C.
NORMAL MODE THEORY FOR COMBINED STRUCTURES Interim Report
William L. Fourney 24 Oct. 1968 20 p refs
(AD-679571; NRL-6776) Avail: CFSTI CSCL 13/13

This report considers a linear elastic structure to consist of several parts; a primary structure which has a rigid base, and one or more substructures which are firmly attached to the primary structure. The normal modes and natural frequencies of the combined structure are determined from a knowledge of the primary structures normal modes and frequencies and the mass and the elastic constants distribution of the secondary structure. The displacements of the total structure are expressed as a series expansion of the scaled normal modes of the primary structure alone, and a set of equations is used to find the normal coordinates of the secondary structures for the new natural frequencies. There is in general an increase in the number of degrees of freedom. The scaling factors involved are determined from the equilibrium equations of the primary structure, with the secondary structure removed and replaced by their internal forces of connection. Numerical examples are presented. Author (TAB)

N69-17610# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Advanced Development Program.
BORON COMPOSITE MANUFACTURING TECHNOLOGY: DEVELOPMENT OF PROCESSES TO FABRICATE AN F-111B/FB-111 BORON COMPOSITE WING-TIP BOX BEAM
A. London Nov. 1968 51 p
(FSR-AD8-10-68.1) Avail: CFSTI

Laminating, bonding, sealing, and machining processes were developed to fabricate components for the boron composite F-111B/FB-111 wing-tip box beam. An autoclave laminating process with provisions to control both boron fiber orientation and resin content to desired limits was developed. The honing/Pasa Jell 107M and Lubeco 300 pretreatment processes were found to be satisfactory for bonding Ti-6Al-4V titanium alloy to boron composite with Metlbond 329 epoxy adhesive. A corrosion-preventing primer and an integral fuel tank fillet sealant were found to be environmental resistance requirements. Conventional chip removal techniques with high-speed-steel and tungsten carbide tools were found to be ineffective with boron composite material. diamond-impregnated cutting tools were most effective and had the longest life of all the cutter types evaluated. Author

N69-17622# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FREE VIBRATIONS OF CYLINDRICAL SHELLS
V. I. Petrov et al 7 Feb. 1968 22 p refs Transl. into ENGLISH from Issled. Uprugosti Plast. (Leningrad), no. 5, 1966 p 170-187
(AD-679658; FTD-HT-23-1094-67) Avail: CFSTI CSCL 20/11

General analysis of free vibration of closed circular cylindrical shells is based on fundamental relationships taken from the theories of shells. The shells are radially supported at their faces. The effect of terms usually neglected in equations of shell motion on frequency is discussed. The simplifying assumptions concerning shell behavior which are associated with these terms are examined for a wide range of variations in shell geometry. Expressions are extended for free vibration of orthogonally anisotropic shells, and a formula for their natural frequencies is obtained. Two-layer shells stiffened by stringers and transverse frames and sandwich shells are analyzed as particular cases. TAB

N69-17629# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
STATUS OF PIPE-RUPTURE STUDY AT GENERAL ELECTRIC: PHASE 2 Status Report
S. R. Vandenberg Jul. 1968 60 p refs
(Contract AT(04-3)-189)
(GEAP-5653) Avail: CFSTI

Activities during the initial 3 years of a broad program are described concerning reliability engineering of reactor piping systems, solution of heretofore intractable problems in stress analysis, fracture mechanics, fatigue studies through bench-scale and large-component tests, and at-reactor tests of the effects of primary coolant environment on the fatigue life of primary piping steels. Author (NSA)

N69-17652# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF AXISYMMETRIC VIBRATIONS OF A SHELL OF REVOLUTION WITH A DOUBLE TURNING POINT
P. Ye. Tovstik 5 Apr. 1968 12 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat., Mekh. i Astron. (Leningrad)
(AD-679939; FTD-HT-23-217-68) Avail: CFSTI CSCL 13/13

The asymptotic method of integrating equations with small parameters in higher derivatives is applied to a system of equations for small axisymmetric vibrations of a thin elastic shell of revolution. Use of the asymptotic method is complicated by a turning point in the resolvent. The article examines a double turning point (the coefficient of the second derivative in the resolvent has a r ot of second-order multiplicity). A standard equation is used whose integrals are expanded into Maclaurin series. Investigation of the asymptotic behavior of these series makes it possible to find a connection between the integrals of the resolvent which are valid to right and left of the turning point. The behavior of the integrals of the resolvent near the turning point is also studied.
Author (TAB)

N69-17675# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
BOLTED JOINTS WITH RECTANGULAR OR CIRCULAR FILLERS
James H. Lee and John W. Fisher Jun. 68 52 p refs Supported in part by the Pa. Dept. of Highways and US Dept. of Transportation
(REPT-318.6; PB-180129) Avail: CFSTI CSCL 13E

Thirty-six tests of bolted joints with either circular washers or rectangular filler plates between the faying surfaces were tested to determine their slip behavior. (USGRDR)

N69-17676# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
EFFECT OF SURFACE COATINGS AND EXPOSURE ON SLIP BEHAVIOR OF BOLTED JOINTS
James H. Lee, Colin O'Connor, and John W. Fisher Jun. 1968 38 p refs Supported in part by the Pa. Dept. of Highways and U.S. Dept. of Transportation
(REPT-318.5; PB-180130) Avail: CFSTI CSCL 13E

Eighteen joints of A36 steel with 1 in. diameter A325 high strength bolts were tested to investigate some effects of surface treatment on slip behavior. All joints were initially blast cleaned. Three had slotted holes. Three were exposed for 2, 6, and 12 months without protection before assembly and testing. Nine were treated with linseed oil or vinyl wash coatings and exposed to an industrial environment for 2 months before testing. Three were treated with vinyl wash coatings but were not exposed to the outside environment. Slotted holes reduced the slip coefficient from 0.65 to 0.49. Exposure without protection reduced the slip coefficient from 0.65 to about 0.4. The slip coefficient with protective coatings was reduced from about 0.28 to 0.26 after 2 months exposure. This reduction is not significant. Author (USGRDR)

N69-17693# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.
DYNAMIC OPTIMIZATION OF A VISCOELASTIC STRUCTURE: THE SEATBELT
W. Nachbar and J. B. Schipmolder Nov. 1968 45 p refs
(Contract N00014-67-A-0109)
(AD-679651; TR-25) Avail: CFSTI CSCL 13/12

Optimization of the parameters of elementary linear viscoelastic models is considered for the design of a lap seatbelt in automobiles. The vehicle is assumed to stop abruptly on impact. The parameters are optimized to allow the speed of the vehicle before impact to have the largest permissible value consistent with constraints imposed for the safety of the user of the belt. The constraints chosen here are: (1) the maximum displacement of the body after impact is equal to or less than a prescribed critical displacement; (2) the forward speed of the body at the critical displacement does not exceed a prescribed maximum value; (3) the force exerted by the belt on the body during the motion following impact does not exceed a prescribed maximum value. It is found that the optimized Kelvin-Voigt viscoelastic model is nearly 40% more effective than the purely elastic material. It is nearly as effective as constant deceleration. An additional and advantageous property is proposed, moreover, for belts of viscoelastic materials. This is that the material should have a relatively low spring rate at relatively small strain rates. The optimized belts for the elementary viscoelastic models are shown to be quite stiff at low strain rates, however.
Author (TAB)

N69-17707# Wisconsin Univ., Madison. Mathematics Research Center.
TWO NEW RESULTS IN POTENTIAL THEORY
G. W. Swan Aug. 1968 10 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-679491; MRC-TSR-896) Avail: CFSTI CSCL 20/11

Two new theorems are derived in the theory of the correspondence between an axially-symmetric potential and a plane potential for biharmonic and harmonic functions. Author (TAB)

N69-17715# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SOLUTION OF BOUNDARY-VALUE PROBLEMS IN THE THEORY OF ELASTICITY FOR PIECEWISE-INHOMOGENEOUS MEDIA BY THE METHOD OF GENERALIZED FOURIER SERIES
Zh. A. Rukhadze 5 Jan. 1968 14 p refs Transl. into ENGLISH of Tr. Gruzinsk. Politekhn. Inst. (USSR)
(AD-679732; FTD-HT-23-1523-67) Avail: CFSTI CSCL 20/11

In an infinite elastic plane is built a finite elastic insert from another material, restricted by a closed boundary, with a constant curvature as regards H. The discontinuities in dislocations and stresses at the interface of the media are given. It is sought to determine the deformed state of the system. The boundary value problem of the elasticity theory for a piecewise inhomogeneous body is quite general despite its seemingly particular nature and the solution of many boundary value problems in statics and oscillation of piecewise inhomogeneous bodies is advanced towards its solution. After making some general suppositions concerning the given data in the problem, the existence of a solution to the problem is proven and presented by Green's formula and an effective method of calculating the approximate values is given. This is accomplished by presenting the solution in the form of generalized Fourier series by a certain complete system of functions. TAB

N69-17737*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IDENTIFICATION OF STRUCTURAL SYSTEMS BY USE OF NEAR-RESONANCE TESTING
John P. Raney and James T. Howlett Washington Feb. 1969 40 p refs
(NASA-TN-D-5069) Avail: CFSTI CSCL 20K

A recent innovation for determining the governing differential equations of motion of a complex structure is described. Numerical values for the mass, stiffness, and damping coefficients of the dynamical equations associated with a particular input response or transmission path are computed from the data usually obtained in

conventional vibration tests of a structure. The theory is based on the dynamic properties of multidegree-of-freedom linear systems. The method requires the steady state response (acceleration, velocity, or displacement) and the driving sinusoidal force input for transmission paths of interest to be determined experimentally for a few frequencies near each major structural resonance. Application of the method is illustrated by determining from experimental data the equations of motion of the 1/10 scale and 1/40 scale models of the Apollo–Saturn V launch vehicle with cantilevered-free and free-free boundary conditions, respectively. Transient responses computed by using the identified equations for the 1/40 scale model are shown to agree favorably with experimental results and to be slightly superior to the results produced by conventional structural analysis. Author

N69-17739 Oklahoma State Univ., Stillwater.
HYPERVELOCITY IMPACT WITH FLOW AND SHOCK PENETRATION THROUGH FLUID, PLASTIC, AND ELASTIC ZONES
Bob Adrian Hardage (Ph.D. Thesis) 1967 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-8415

On the basis of studies on hypervelocity impact, a complete analytical model for the flow and shock propagation during the impact was formulated and converted to a computer program. The program follows the hypervelocity impact for the duration of the phenomena. The solution shows variations with time of the size and shape of the fluid, plastic and elastic regions of the target; the energy and momentum of the material ejected from the crater; the behavior of the shock wave during the formation of the crater; the final size of the crater; and the shape of the shock wave in the elastic material which surrounds the impact zone. The impacting body is a porous, silicate sphere, and the target is a semi-infinite aluminum slab. Several material interfaces are created during the impact. The program monitors the motion of all of these interfaces as they move through an Eulerian, finite-difference mesh. Dissert. Abstr.

N69-17766*# Barry Wright Corp., Watertown, Mass.
LOSS FACTOR AND RESONANT FREQUENCY OF VISCOELASTIC SHEAR-DAMPED STRUCTURAL COMPOSITES
Thomas F. Derby and Jerome E. Ruzicka Washington NASA Feb. 1969 20 p refs
(Contract NAS1-7580)
(NASA-CR-1269) Avail: CFSTI CSCL 20K

An investigation is conducted to evaluate the loss factor, resonant frequency and thermal conductivity characteristics of structural composites with viscoelastic shear damping mechanisms. Theoretical solutions and graphical design data for damping and resonant frequency are developed for four types of viscoelastic shear damped structural composites: two elastic-element, symmetrical three elastic element unsymmetrical three elastic-element; and N identical elastic laminate configurations. The equations and design procedures for predicting loss factor and resonant frequency are verified by the results of experimental measurements made on laboratory beam specimens. Thermal conductivity characteristics of laminated viscoelastic shear-damped plates are investigated theoretically and experimentally, with consideration given to methods for increasing thermal conductivity and the subsequent effect on structural damping. Author

N69-17770*# Washington Univ., Seattle.
PHOTOVISCOELASTIC MODEL TESTING
Charles W. Fowlkes Washington NASA Feb. 1969 97 p refs
(Grant NsG-401)
(NASA-CR-1289; REPT-68-2) Avail: CFSTI CSCL 20K

The experimental procedures necessary to perform a complete two-dimensional viscoelastic stress analysis using the photoviscoelastic method are outlined. These procedures are illustrated in the solution of several example problems. The example problems cover the range of variables encountered in photoviscoelastic model testing. A description of the necessary laboratory apparatus is included. Author

N69-17812# California Univ., Berkeley. Inst. of Transportation and Traffic Engineering.
ASPHALT MIXTURE BEHAVIOR IN REPEATED FLEXURE: A STUDY OF AN IN-SERVICE PAVEMENT NEAR MORRO BAY, CALIFORNIA
C. L. Monismith, D. A. Kasianchuk, and J. A. Epps (Calif. Mater. and Res. Dept.) Dec. 1967 73 p refs Prepared in cooperation with US Dept. of Transportation
(TE-67-4; PB-180223) Avail: CFSTI CSCL 13B

The report is part of a continuing study of the fatigue response of asphalt paving mixtures which includes not only the behavior of mixtures in repeated flexure but also consideration of the fatigue factor in the design of A. C. pavements. For this project, investigations have included: (1) laboratory fatigue tests both on specimens sawed from the asphalt concrete course and on laboratory-prepared specimens with the same components; (2) triaxial compression repeated load tests on the other components of the pavement section as well as the subgrade material; and (3) prediction of the potential for fatigue distress in this pavement section. USGRDR

N69-17853*# Little (Arthur D.), Inc., Cambridge, Mass.
CONCEPTUAL DESIGN AND ANALYSIS OF SHADOW SHIELD SYSTEMS FOR THERMAL PROTECTION OF CRYOGENIC PROPELLANTS Interim Report
F. Gabron and D. Nathanson 1 Jul. 1968 218 p refs
(Contract NAS3-10292)
(NASA-CR-72369; ADL-C-69507) Avail: CFSTI CSCL 22B

A study was made to determine the effectiveness of shadow shields for the long term thermal protection of a spaceborne liquid hydrogen storage vessel. A number of shadow shield conceptual designs were evaluated for an upper stage configuration in which the shadow shields were located between a sun oriented, 10-foot diameter payload and a nine-foot diameter liquid hydrogen tank. The designs were evaluated on the basis of the system mass penalty (the mass of the shadow shields and payload support structure plus the mass of liquid hydrogen vaporization for a 10,000-hour mission) and inherent reliability. Author

N69-17893*# New York Univ., N. Y. Dept. of Aeronautics and Astronautics.
SOLUTIONS FOR THE DIFFRACTION OF A PLANE SHOCK WAVE BY GENERAL TWO-DIMENSIONAL DISTURBANCES
Y. S. Pan Oct. 1968 59 p refs
(Grant NGR-33-016-119)
(NASA-CR-99328; NYU-ASL-68-42) Avail: CFSTI CSCL 20K

Solutions for the diffraction of a plane shock wave by general two-dimensional weak disturbances are obtained. The technique employed is an extension of the method developed by Ting and Ludloff for the solution of aerodynamics of blasts. Disturbances due to a solid body are prescribed by distributions of sources, doublets and vortices in a two dimensional case and by a distribution of point sources in an axisymmetric case. The disturbance pressure behind an advancing shock is expressed by integrals of distributions

The shape of diffracted shock and other disturbance quantities are expressed in terms of disturbance pressure behind the shock and disturbance velocity components ahead of the shock. Application to shock diffraction of thin structure in still air is shown. Some other applications are indicated. Author

N69-17909# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF SHOCK PHENOMENA BY A LASER INTERFEROMETER [UNTERSUCHUNG VON STOSSVORGAENGEN MITTELS EINES LASER-INTERFEROMETERS]
H. J. Pfeifer, H. D. vom Stein, E. David, and B. Koch 14 Dec. 1967 32 p refs In GERMAN
(Contract T-759-I-206)
(ISL-12/67) Avail: CFSTI

The time-propagation velocity of two shocked spheres in central confrontation with each other was studied by Doppler laser. Interferometer at measurement intervals of at least 150Å and at at maximal frequency beats of 3 MHz. This compared to a propagation velocity of about 1 m/s. Investigated was an elastic and an inelastic shock. Elastic shock results agreed well with the Hertz theory. The method can be used to investigate motion velocity segments of arbitrarily shaped bodies. Author

N69-17949 Illinois Univ., Urbana.
COMBINED RANDOM AND PERIODIC VIBRATIONS OF LINEAR SYSTEMS
Richard Glenn Carlson (Ph.D. Thesis) 1967 67 p
Avail: Univ. Microfilms: HC $3.50/Microfilm $3.00 Order No. 68-8039

Complete, systematic techniques of analysis applicable to linear, mechanical systems excited by combined random and periodic input signals are developed. These techniques could be applied to the analysis of roadway excitation of vehicles, construction and agricultural equipment vibration during operation, electrical component failure, gear tooth mating, and a multitude of other problems. After development of analytical procedures, consideration is given to the development of specialized techniques which are valid when specific restrictions are imposed on the output root mean squares of the respective random and periodic components; this development is important because of the labor saving features of the specialized techniques. A Fourier series approach (i.e., a deterministic approach) for the combined excitation is ascertained for some restricted cases. The validity is specified in terms of root mean square of the periodic component, root mean square of the random component, and the number of significant Fourier components used to describe the random component of the output signal. The analytical work was verified through an experimental program. Dissert. Abstr.

N69-17956# New Jersey State Dept. of Transportation, Bureau of Structures and Materials.
STATISTICAL CORRELATION AND VARIANCE ANALYSIS PROJECT RELATED TO THE QUALITY CONTROL OF HIGHWAY MATERIALS. PART 1: STRUCTURAL CONCRETE
Sep. 1968 103 p refs Prepared in cooperation with the Bureau of Public Roads
(PB-180261) Avail: CFSTI CSCL 13C

The 28-day structural and prestressed concrete historical compressive strength data from 3000 cylinders prepared in 1964 by personnel at the job site were statistically analyzed to estimate conformance to existing criteria. Testing sampling and material and total variance, standard deviation, mean coefficient of variation was determined for each project sublot. AQL (Acceptable quality levels) of 2.5% for prestressed concrete (5000 psi minimum) and 6.5% for other structural concrete (3000 psi minimum) were selected to best approximate computed test values. Suggestions were made to revise States existing prestressed concrete specifications to reduce the risk of accepting excessive poor quality materials. USGRDR

N69-17957# Los Alamos Scientific Lab., N. Mex.
NEUTRON FLUX MEASUREMENTS IN URANIUM METAL EXPONENTIAL COLUMNS OF 6.53% AND 9.12% U 235
R. G. Steinke 24 Oct. 1968 11 p refs
(Contract W-7405-ENG-36)
(LA-3934) Avail: CFSTI

Material bucklings measured in the equilibrium neutron spectra of heterogeneous uranium metal exponential columns containing 9.12% and 6.53% ^{235}U are reported. These results of exponential-column measurements are compared with values computed by means of Hansen–Roach cross sections. Through application of a fine-structure insert in the equilibrium spectral region of each column, fission cross-section ratios are structure-averaged. The measured spectral indices are given. Author (NSA)

N69-17965 Kansas Univ., Lawrence.
THE INFLUENCE OF IMPERFECTIONS AND EDGE RESTRAINT ON THE BUCKLING AND AEROELASTIC STABILITY OF CYLINDRICAL SHELLS
Gerald Willis Barr (Ph.D. Thesis) 1967 125 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-6903

The aeroelastic stability characteristics of thin isotropic circular cylindrical shells in the presence of supersonic flow were investigated theoretically. The primary objective was to develop an analytical tool to be used in designing thin shell structures subjected to unsteady aerodynamic loading. The results of several recent wind tunnel tests indicate that a large discrepancy exists between the classical theory and experiment. Several existing theories predict that cylindrical shells flutter at much higher levels of free stream energy than observed experimentally. It is suggested that the next logical step towards a correct solution to the aeroelastic stability problem is to include the influence of initial geometric imperfections. Nonlinear Donnell-type shell equations are coupled with one of several aerodynamic theory approximations in the investigation. It was concluded that the generalized slender body aerodynamic approximation is not adequate in its present form to predict the low supersonic aeroelastic instability of a thin cylindrical shell as observed experimentally. Dissert. Abstr.

N69-17992*# College of the Holy Cross, Worcester, Mass.
REPLICA GRATING STUDY Phase 5 Interim Report, 30 Jun.-31 Dec. 1968
Roy C. Gunter, Jr. 15 Jan. 1969 18 p
(Grant NGR-22-091-002)
(NASA-CR-99329) Avail: CFSTI CSCL 20K

Preliminary thermal vacuum in-situ testing was started using a new refrigerant with thermal range in excess of −90°C to +150°C. The trial tests, using an obsolete replica grating of known limited thermal range, showed a deterioration in beamwidth at both 1216A and 4471A increasing slowly until 55°C and thereafter deteriorating more rapidly. A cooling back to the initial 25°C did not show an elasticity in the sense that the beamwidth did not return to the initial low value. Testing at reduced temperatures will be undertaken as soon as a new pump capable of handling the relatively high viscosity of the refrigerant at the lower temperatures is delivered. Stress by energetic radiation has continued and the range of materials has been expanded to include virtually all those now used for making replica diffraction gratings. These materials are Pyrex, BSC2, synthetic fused silica, fused quartz, Vycor, and Cervit. Author

N69-18002 California Univ., Berkeley
FINITE ELEMENT ANALYSIS OF SKEW COMPOSITE PLATES
Mehrdad Mehrain (Ph.D. Thesis) 1967 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-10370

The finite element method using a displacement model is employed to analyze the behavior of linearly elastic skew composite (eccentrically stiffened) plates. The flexural rigidity of the system under study is considered as a combination of stiffnesses due to in-plane and plate bending stresses in the plate elements and in-plane and beam bending stresses in the beam stiffener elements. For each type of element, several stiffness matrices have been derived and properties of each examined and compared. Two computer programs have been written to assemble the system of finite elements and to solve for the displacements and the internal stresses in the deck plate and the stiffening beams. Several numerical solutions are given to illustrate the convergence and accuracy of the solution. Dissert. Abstr.

N69-18006 Illinois Univ., Urbana.
NONLINEAR SYMMETRICAL VIBRATIONS OF A CIRCULAR PLATE ON AN ELASTIC FOUNDATION
Richard Bolton (Ph.D. Thesis) 1967 65 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-8027

Herrmann's equations, the dynamic analogs of the Von Kármán equations, are solved by assuming a series solution of the separable form involving unknown time functions. The special functions include both regular and modified Bessel functions and are chosen to satisfy the linear natural frequencies of the plate as well as the usual edge conditions. Total differential equations governing the symmetric plate motions are derived using the Galerkin averaging techniques for a uniform load. The equations are solved first for the static case where curves of dimensionless deflection versus a dimensionless load parameter are given for various values of the dimensionless stiffness parameter λ. Using single mode response, the dynamical equations are solved for both free and harmonically forced vibrations. Curves show the ratio of the periods of nonlinear and linear vibrations versus the dimensionless amplitude. Normal mode response is then considered and the coupled equations are solved using averaging and perturbation techniques. The equations of the "backbones" and the amplitude ratios are derived for the first two nonlinear modes with no modal diameters. The limitations of single mode response are examined and compared with normal mode. Results are obtained for fixed and simply supported plates on elastic foundations with both immovable and movable edges. Dissert. Abstr.

N69-18015# Weidlinger (Paul) Consultants, New York.
EFFECTS NEAR THE SURFACE OF AN ELASTIC HALF-SPACE DUE TO A PRESSURE LOAD DECELERATING THROUGH SONIC SPEED
M. B. Friedman, M. K. Myers, and H. H. Bleich Mar. 1968 47 p refs
(Contract DA-49-146-XZ-508)
(AD-679638; DASA-2144) Avail: CFSTI CSCL 20/11

Some unusual near surface effects due to air blasts on a solid half-space are studied by an analytic treatment of the stress field in an elastic half-space subjected to a two dimensional uniform pressure applied suddenly and permitted to expand with a linearly decreasing velocity from an initial supersonic velocity. A partial solution is obtained in closed form by asymptotic methods. The results indicate the presence of very large gradients of stress in the neighborhood of the surface of the half-space as the velocity of the surface pressure approaches and passes through the velocity of P-waves. Author (TAB)

N69-18045*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.
THE LIBRATIONAL DYNAMICS OF DEFORMABLE BODIES
T. P. Mitchell and J. Lingerfelt 30 Jan. 1969 17 p
(Grant NGR-05-010-020)
(NASA-CR-99334) Avail: CFSTI CSCL 20K

The volume average of the strain tensor in a body moving in an inverse-square force field is evaluated. The calculation is carried out assuming the satellite to be an isotropic elastic body whose center of mass moves in a planar orbit. An approximate expression, in terms of its volume and elastic properties, is presented for the strain energy in the satellite. Using this expression the equation of planar librational motion is written explicity. This equation is discussed for both circular and elliptic orbits and is modified to include the effects of energy dissipation in the body. It is shown that the concept of Adiabatic Invariants allows one to analyze the influence of slow changes in the material volume and elasticity. Author

N69-18094 Oklahoma State Univ., Stillwater.
COUPLED AND UNCOUPLED PANEL RESPONSE TO SONIC BOOM TYPE INPUTS
Gerald D. Whitehouse (Ph.D. Thesis) 1967 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8521

The response of a simply supported panel was studied to determine conditions where peak responses might occur. In one case, the panel was mounted in a baffle, and in another case, the panel was mounted in the wall of a Helmholtz resonator and a transient excitation pressure pulse in the shape of a typical sonic boom pressure wave was applied to the resonator neck. The configuration of the panel in the baffle was studied as a distributed damped system with a normal incidence N-wave pressure pulse. The panel coupled to the resonator was idealized as a lumped parameter system using an equivalent system derived on energy relationships. An experimental model was constructed and data obtained to validate the predicted response. Results of the study are applied toward the analysis of a large glass window which was broken during a flight in which a sonic boom occurred. Dissert. Abstr.

N69-18095 North Carolina State Coll., Raleigh.
BOUNDARY VALUE PROBLEMS IN ANISOTROPIC ELASTICITY
Ruen Chiu Tang (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-9014

A characteristic sixth-order partial differential equation for three-dimensional rectilinear anisotropic bodies is formulated and solved using a triply-infinite power series. The problem of stress concentration in the neighborhood of a square hole with rounded corners in an infinite rectilinear anisotropic plate is investigated by using the theory of functions of a complex variable. Numerical values of the stresses at the edges for a spruce plank are calculated. The characteristic fourth-order partial differential equations with variable coefficients for cylindrical anisotropy and rectilinear anisotropy in polar coordinates are formulated. Dissert. Abstr.

N69-18096# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Advanced Development Program.
A FINITE ELEMENT TECHNIQUE FOR THE ELASTIC PLASTIC AND ANISOTROPIC BUCKLING ANALYSIS OF STIFFENED RECTANGULAR PLATES
Harry G. Harris and Allan B. Pifko Nov. 1968 151 p refs
(FSR-A02-01-68.6) Avail: CFSTI

This report presents a finite element method, developed within the framework of the stiffness method of structural analysis, for the stability analysis of stiffened rectangular plates. Complete generality is maintained in the description of the plate material properties so that material anisotropy or isotropy can be treated, as well as plastic yielding prior to buckling. The buckling behavior of various stiffened plates with different combinations of applied load is considered. The results obtained using the finite element method for plastic as well as elastic buckling of these stiffened plates compare very well with results from other analytical techniques. The finite-element method is demonstrated for a practical example of an aircraft type structure by examining the buckling behavior of an integrally stiffened wing cover. A general computer program written for the IBM 360/75 computer was used to handle the computations with a minimum of input data. An explanation of the use of this program and a complete FORTRAN IV listing is provided at the end of this report together with sample problem output. Author

N69-18097 Michigan State Univ., East Lansing.
HARMONIC DISPERSION ANALYSIS OF INCREMENTAL WAVES IN UNIAXIALLY PRESTRESSED PLASTIC AND VISCO-PLASTIC BARS, PLATES, AND UNBOUNDED MEDIA
Roy Albert Williams (Ph.D. Thesis) 1967 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-7984

The equations governing the propagation of infinitesimal incremental loading stress waves in a medium prestressed uniaxially into the plastic region are derived for a strain-rate-independent and a strain-rate-dependent constitutive equation. With the assumption that a loading wave exists in the medium and that such a loading wave could be constructed with the use of generalized Fourier analysis and synthesis, the equations derived were applied to a harmonic analysis of the following three problems: (a) Plane waves in an unbounded medium. (b) Longitudinal waves in an infinitely long cylindrical rod. (c) Symmetrical longitudinal waves of plane strain in an infinitely long and infinitely wide thin flat plate. The frequency equations relating wave speed to the frequency of the wave are found and solved by numerical methods and the dispersion curves for the two theories are constructed and compared with the corresponding dispersion curves for the corresponding elastic problems. Dissert. Abstr.

N69-18206#
ELASTIC STABILITY OF MULTILAYER ORTHOTROPIC CONICAL SHELLS
I. N. Preobrazhenskii [1968] 8 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 4, no. 11, 1968 p 9-16
Avail: CFSTI

The stability of multilayer, structurally orthotropic, conical shells, whose material is subject to Hooke's law, is considered. The problem is solved by an energy method. An equation is deduced which permits finding the computational values of the critical axisymmetric loadings; as a particular case, equations are obtained for critical loadings under the effect of just axial forces and external pressure. The proposed solutions are given in a linear formulation. Author

N69-18215#
RANDOM VIBRATIONS OF MULTISPAN PLATES
V. N. Moskalenko [1968] 8 p refs Transl. into ENGLISH from Inzh. Zh., Mekhan. Tverdogo Tela (Moscow), no. 4, 1968 p 79-84
Avail: CFSTI

A solution is given of stochastic problems of exciting multispan plates on equidistant supports with identical properties. The external force field is considered a random space-time function, almost certainly representable as a canonical integral expension. The method is based on reduction of the recurrent portion of the system of equations written for the constants of integration for the different spans to diagonal form. It is noted that the number of constants ought first be cut down in the case of rigid supports. It is shown that the complexity of the calculations does not increase as the number of supports increases. As an illustration, the solution is given for the problem of exciting a plate of infinite span on absolutely rigid supports under cylindrical bending. The random field for a turbulent boundary layer is used as the external pressure field. Author

N69-18218# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
STUDY OF THE SMALL HARMONIC VIBRATIONS OF A HEATED STRUCTURE, IN THE VICINITY OF A LOADING STATE CORRESPONDING TO A PARTIAL ENTRY INTO THE DOMAIN [ETUDE DES PETITES VIBRATIONS HARMONIQUES D'UNE STRUCTURE CHAUFFEE AUTOUR D'UN ETAT DE CHARGEMENT CORRESPONDANT A UNE ENTREE PARTIELLE DANS LE DOMAINE PLASTIQUE]
Henri Loiseau 1968 12 p refs In FRENCH; ENGLISH summary Presented at the 6th Intern. Congr. of Aeron. Sci., Munich, 9-13 Sep. 1968 Submitted for publication
(ONERA-TP-604) Avail: CFSTI

An experimental instrumentation has been created at O.N.E.R.A. to determine the dynamic characteristics of an aircraft or missile submitted to heavy loads and to a large heat flux. In particular, it permits it to follow the evolution of the vibration eigenvalues on a continuous manner during the phase of kinetic heating, simulated for instance thanks to a heating apparatus using infrared tubes. This apparatus has been successfully used for studying small vibrations of materials in the plastic domain, or of models or full size structures. Author (ESRO)

N69-18227# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
PRINCIPLE OF A METHOD FOR OBTAINING LONG-DATED CREEP CHARACTERISTICS FROM SHORT DURATION RELAXATION TESTS [PRINCIPE D'UNE METHODE D'OBTENTION DES CARACTERISTIQUES DE FLUAGE A LONG TERME A PARTIR D'ESSAIS DE RELAXATION DE COURTE DUREE]
Jean Lemaitre 1968 22 p refs In FRENCH; ENGLISH summary Presented at the 5th Intern. Congr. of Rheol., Kyoto, 7-11 Oct. 1968 Submitted for publication
(ONERA-TP-639) Avail: CFSTI

The creep calculations of metallic structures of long life-time (several years) are currently made from experimental data obtained in a short time by the so-called 'extrapolation' methods. A new method, based on a behavioral law, not presented here, permits to avoid using simulation parameters. Its principle lies in the use of rheologic states defined by relaxation experiments to restore, through the state parameters, the creep curves. The important time saving is due to the strongly nonlinear character of visco-plastic materials. A number of results have been obtained on materials rheologically stable, and in a plastic deformation velocity range whose inferior limit is 10^{-6} s^{-1}. The method is presently developed through the realization of a 'multiple relaxation device' designed to reach velocities applicable to the real needs of industry (10^{-11} s^{-1}). ESRO

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-17242# Institut Franco-Allemand de Recherches, St. Louis (France).
CONTRIBUTION TO THE STUDY OF THE DISTRIBUTION OF HEAT FLUX BY CONVECTION EXERTED ON A MOCK-UP OF REVOLUTION IN HYPERSONIC FLIGHT. PRACTICAL FORMULAS [CONTRIBUTION A L'ETUDE DE LA REPARTITION DU FLUX DE CHALEUR PAR CONVECTION SEXERCANT SUR UNE MAQUETTE DE REVOLUTION EN VOL HYPERSONIQUE. FORMULES PRATIQUES]
J. Luneau 8 Jun. 1967 27 p refs In FRENCH
(ISL-T-19/67) Avail: CFSTI

Presented is a mathematical model for laminar or turbulent heat flow caused by convection of the moving point along the generatrix of a hypervelocity rotational body flying through high pressure air. Results of the calculations compare well with exact theories. Transl. by G.G.

N69-17270 Southern Methodist Univ., Dallas, Tex.
HEAT TRANSFER ACROSS SURFACES IN CONTACT: STUDIES OF TRANSIENTS IN ONE-DIMENSIONAL COMPOSITE SYSTEMS
Clifford James Moore, Jr. (Ph.D. Thesis) 1967 245 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.20 Order No. 68-9668

Solutions are derived for a class of boundary value problems for the time-dependent temperature distribution in a two layer, composite slab with contact resistance at the interface and contact or convective resistance on the outer boundaries. The results of a parametric computer study using these solutions are presented. This study includes a set of dimensionless correlations of an arbitrarily defined time to approach steady state and a discussion of some transient thermal phenomena which are characteristic of systems of this type. The applicability of these solutions for the prediction of the transient behavior of real composite systems is evaluated by comparison with experimental results. Experimental data are presented for the transient thermal response of several composite metal systems when subjected to thermal transients which closely approximated the boundary conditions of the theoretical solutions. Dissert. Abstr.

N69-17271# Institut Franco-Allemand de Recherches, St. Louis (France).
PHOTOGRAPHIC STUDY OF SELF-ILLUMINATED HYPERSONIC WAKE CAUSED BY ABLATING SPHERE [ETUDE DU SILLAGE HYPERSONIQUE D'UNE SPHERE EN ABLATION A L'AIDE DE PHOTOGRAPHIES EN LUMIERE PROPRE]
J. Vauvrecy 29 Dec. 1967 42 p refs In FRENCH
(ISL-T-47/67) Avail: CFSTI

Luminous ablative emission from hypervelocity (5000 m/s) spheres traveling in low pressure atmospheres (air or nitrogen at 10 to 100 Torr pressure) was studied by photocathode cameras. Emphasis was placed on flow instability and geometry of the hypersonic wake. Observed was an intermediate flow with Reynolds number close to the critical point. Transl. by G.G.

N69-17272# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL STUDY OF ABLATION ON METALLIC SPHERES FIRED AT HIGH VELOCITY [ETUDE EXPERIMENTALE DE L'ABLATION SUBIE PAR DES SPHERES METALLIQUES LANCEES A GRANDE VITESSE ET TENTATIVE D'INTERPRETATION]
J. Luneau 1 Sep. 1967 47 p refs In FRENCH
(ISL-T-33/67) Avail: CFSTI

Hypervelocity spheroid models were fired into a reentry simulator and collected after ablation. Ablative profiles showed almost rotational symmetry and came closest to conical form in highly ablative spheres. Theoretical calculations showed that ablation was caused by the turbulent heat flow which in turn increased with higher flight speeds. The ablative force of the heat flow was one eighth to one tenth of flight velocity. Transl. by G.G.

N69-17293# Institut Franco-Allemand de Recherches, St. Louis (France).
DETONATION PHYSICS CONFERENCES. PART 1: GAS DYNAMICS THEORY OF IDEAL DETONATION [VORTRAEGE UEBER DETONATIONSPHYSIK. TEIL 1: GASDYNAMISCHE THEORIE DER IDEALEN DETONATION]
F. Wecken 1 Aug. 1967 165 p refs In GERMAN Seminar held in summer, 1966
(ISL-6/67-Pt-1) Avail: CFSTI

Lectures given during the conference on detonation physics cover the aspects of gas dynamics in one dimensional stationary detonation front structures. Compression shocks and shocks with wake relaxation are used to develop the classical Rayleigh process theory. The Chapman–Jouguet effects are analyzed and modified and physicochemical aspects of detonation wakes behind explosives are discussed. Transl. by G.G.

N69-17391# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SIMULATION OF THE HEAT-TRANSFER PROCESSES IN IONIZED GASES IN THE PRESENCE OF AN ELECTROMAGNETIC FIELD [MODELIROVANIYE PROTSESSOV TEPLOVOGO PERENOSA V IONIZOVANNYKH GAZAKH PRI NALICHII ELEKTROMAGNITNOGO POLYA]
E. Ya. Blum 22 Sep. 1967 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latv. SSR, Ser. Fiz. i Tekhn. Nauk (Riga), no. 4, 1965 p 18–27
(AD-675434; FTD-HT-23-753-67) Avail: CFSTI CSCL 20/9

The paper deals with a theoretical analysis to determine the heat-transfer similarity conditions in a magnetohydrodynamic flow. The possibilities of modelling the heat-transfer in ionized gases by using electroconducting liquids are shown. Electrolytic solution was found to be applicable to heat-transfer modelling in low-ionized gases, whereas liquid metal was found to be more appropriate in cases of high temperature. Author (TAB)

N69-17424 Pennsylvania Univ., Philadelphia.
A QUASI-STEADY METHOD FOR MEASURING THE THERMAL DIFFUSIVITY OF MOLTEN SALTS
Krishnamachar Sreenivasan (Ph.D. Thesis) 1967 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-9243

A quasi-steady method for measuring the thermal diffusivity of molten salts at temperatures above their melting point is described. Essentially, the difference between the temperature at the surface and at the center of a cylindrical container is measured for

a constant rate of surface temperature rise. The liquid, whose thermal diffusivity is to be measured, is contained in a narrow annular groove concentric with the surface. The advantages of this method are: (1) No heat flux measurements are needed. (2) No liquid temperature need be measured. (3) Theoretically assumed boundary conditions can be experimentally realized. (4) Absence of convection can be experimentally verified. Results of measurement are reported for lithium fluoride and sodium nitrate. The results for sodium nitrate agree with previously published results. Methods to calculate theoretically the thermal conductivity of liquids are presented. Dissert. Abstr.

N69-17438*# Lockheed Missiles and Space Co., Palo Alto, Calif.
EFFECT OF SHOCK PRECURSOR HEATING ON RADIATIVE FLUX TO BLUNT BODIES
L. E. Lasher and K. H. Wilson Washington NASA Feb. 1969 23 p refs
(Contract NAS7-509)
(NASA-CR-1265) Avail: CFSTI CSCL 22C

A solution using a one dimensional heating representation is used to determine the precursor heating correction to the surface flux. Based on these results, one can judge when a fully coupled radiative-gasdynamic flow analysis is needed. The conservative absorption model predicts only a 10% effect at U_∞ = 65,000 fps on the surface radiative heat flux. A correction of this order is not considered to be sufficiently important to justify a detailed coupled solution. When the cold air is preheated substantially, the absorption resulting from this model may be underestimated. A liberal absorption model is considered and indicates that at a velocity of 60,000 fps the correction to surface radiative flux would amount to 25%. The true coupling effect of the precursor heating probably lies somewhere between the results produced by the two absorption models. The conclusion is reached that for velocities less than 60,000 fps precursor heating effects are relatively unimportant in determining the radiative flux reaching the body surface. At velocities greater than 60,000 fps the amount of energy loss from the shock layer and a resultant precursor heating correction is felt to be sufficiently large to justify a more detailed analysis. Author

N69-17501# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
A THEORETICAL STUDY FOR INITIATION OF HIGH-FREQUENCY COMBUSTION OSCILLATION IN PREMIXED GAS ROCKET
Tadao Takeno Nov. 1968 44 p refs *Its* Vol. 33, No. 12, p 309-347
(ISAS-430) Avail: CFSTI

A theoretical study for initiation of high-frequency combustion oscillation in the premixed gas rocket was conducted. A generalized wave equation which governs the behavior of pressure disturbances in a chemically reacting flow field was derived through the linearization of the fundamental equations. It was shown that the behavior of pressure disturbances depends only on the variation in heat release rate, being independent of the individual chemical reaction processes through which this variation is provided. It was also shown that the equation can be used for the analysis of heat-driven oscillation when the response of heat source to flow disturbances is known. The space condition for the occurrence of heat-driven oscillation was found to depend upon the way of response of heat source to flow disturbances, while the time condition was found to be independent of it. For the occurrence of high-frequency combustion oscillation in the premixed gas rocket, a simplified analytical model of heat-driven oscillation with an insensitive time delay was postulated on the basis of the previous experimental studies. The incipient amplification rate of the oscillation was calculated as the function of propellant equivalence ratio and combustion chamber length. The calculated oscillation boundary was found to correlate very well with the experimentally observed boundary. Author

N69-17540# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENERALIZATION OF CHARACTERISTICS OF ELECTRIC ARC HEATERS
S. S. Kutateladze 15 Jan. 1968 8 p refs Transl. into ENGLISH from Inzh.-Fiz. zh. (Moscow), v. 7, no. 4, 1964 p 25-27
(AD-679731; FTD-HT-23-1307-67) Avail: CFSTI CSCL 20/13

Low-temperature heaters with turbulent gas stabilization air and nitrogen were used as an example to show the possibility of generalizing the volt-ampere characteristics of electric arc heaters. In this treatment of the problem, the independent parameters are the geometry of the anode and cathode, the geometry of the gas vortex, the intensity of the current passing through the electric arc, the gas flow rate, and the kind of gas. A criterial equation is derived which correlates the volt-ampere characteristics of such heaters. It was found that, despite appreciable changes in the parameters, all the data can be represented by a single curve in generalized coordinates. This shows that even the description of such complex phenomenon as an electric arc can in certain cases be carried out with a small number of criteria. Author (TAB)

N69-17554# Dynatech Corp., Cambridge, Mass.
INVESTIGATION OF BOILING FLOW REGIMES AND CRITICAL HEAT FLUX Final Summary Report
A. E. Bergles, J. P. Roos, and J. G. Bourne Jul. 1968 174 p refs
(Contract AT(30-1)-3304)
(NYO-3304-13; REPT-797) Avail: CFSTI

An investigation of boiling flow regimes and critical heat flux was conducted. The experimental facility consisted of a water loop and a recirculating steam loop supplying electrically heated test sections. The steam loop was found to be a practical and economical method of increasing the capacity of the facility. Film thickness and critical heat flux measurements established that the data obtained with two-phase inlet conditions were comparable to those obtained with single-phase inlet conditions, provided that the annular mixer was properly adjusted and the test section was sufficiently long. The instrumentation developed for study of the flow structure included a traversing electrical probe, for determination of the general flow regime and measurement of the thickness of the annular liquid film, and a traversing isokinetic sampling probe, for examination of core entrainment in annular flow. Author (NSA)

N69-17682# State Univ. of New York, Stony Brook. Coll. of Engineering.
INFRARED RADIATIVE ENERGY TRANSFER IN GASEOUS SYSTEMS Final Report, Sep. 1966-Jun. 1968
R. D. Cess, S. N. Tiwari, and A. E. Sotak Wright-Patterson AFB, Ohio ARL Aug. 1968 51 p refs
(Contract AF 33(615)-3104)
(AD-679602; ARL-68-0151) Avail: CFSTI CSCL 20/13

The object of this investigation was to study infrared radiative energy transfer within real gases, and several simple gaseous systems were analyzed. The first consisted of a gas bounded by two parallel plates having the same temperature. Within the gas there was a uniform heat source per unit volume. For this system, both wall emissivity effects and radiation-conduction interactions were investigated. The second system consisted of fully-developed laminar flow and heat transfer in a parallel plate duct under the boundary condition of a uniform surface heat flux. In addition, an approximate method was developed such that the results for the

parallel plate duct could be applied to fully-developed laminar flow and heat transfer through a circular tube. This latter case was also studied experimentally using a 2.37 cm diameter tube. Nonabsorbing gas results were first obtained employing nitrogen, while the absorbing gas experiments utilized both carbon dioxide and nitrous oxide. Comparison of analytical and experimental results showed that the analysis underpredicted the ability of the absorbing gases to transmit radiative energy. This was probably due to neglecting certain weak vibration-rotation bands in formulating the analysis. The results were, however, in qualitative agreement. Author (TAB)

N69-17589# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FRICTION AND HEAT EXCHANGE IN A TURBULENT BOUNDARY LAYER ON A POROUS SURFACE DURING INJECTION OF DROP FORMING LIQUIDS AND GASES
P. N. Romanenko et al 29 May 1968 20 p refs Transl. into ENGLISH from Tepło- Massoperenos (Minsk), v. 2, 1965 p 28-289
(AD-679540; FTD-MT-24-115-68) Avail: CFSTI CSCL 20/13

Air friction and heat-transfer relations were studied for a stream of evaporating liquid or gas passing through a porous wall and functioning as coolant while the air supplying the heat passes along the wall in turbulent flow. A Cu plate with 35% porosity was used as a model of the porous wall. Water, EtOH, and glycerol were used as evaporating liquids. The coolant gases were He, air, Ar, Freon-12, and Freon-12-air mixtures, the molecular weight of the coolant gases varying from 4 to 121. To determine the friction coefficients, a nonporous plate was subjected to the air flow at temperatures and Reynolds numbers corresponding to those at which the coolant was blown in. The effect of cooling with water and EtOH on the average values of the dimensionless heat-transfer coefficients was determined at desired thermal parameters of injection. TAB

N69-17602# Atomic Energy Establishment, Winfrith (England).
SLIP: A DYNAMIC PROGRAMME FOR THE THERMAL-HYDRAULIC BEHAVIOUR OF BOILING LOOPS
P. Moxon Aug. 1968 50 p refs
(AEEW-R-448) Avail: CFSTI; UK 7s

SLIP is a dynamics programme (in FORTRAN) for solving the thermal-hydraulic equations describing an electrically heated rig. The heater may be a single tube cooled from within and insulated from the atmosphere externally, or it may be a bundle of heater rods each cooled on the outer surface. The axial power distribution is arbitrary. The hydraulic circuit consists of the heated section, a number of risers in series, a single-phase downcomer containing a pump and a single-phase bypass across the test-section and risers. There is no explicit representation of a steam drum. The system may be disturbed by imposing variations on power, inlet sub-cooling, inlet velocity or pump pressure head. Output includes axial distributions of heat flux void fraction, coolant density, dryout margin, as well as loop pressure losses. An optional extra is a Fourier analysis of certain items of output enabling a calculated cyclic response to be represented in terms of the various harmonics.
Author (NSA)

N69-17644# New York Univ., N. Y. Dept. of Aeronautics and Astronautics.
SLOT COOLING AT HIGH SPEED FLOW Interim Scientific Report
Gdalia Kleinstein Washington ARL Aug. 1968 43 p refs
(Contract F33615-68-C-1184)
(AD-679837; NYU-AA-68-24; ARL-68-0141) Avail: CFSTI CSCL 20/4

The problem of slot cooling at high speed flows is investigated assuming laminar flow conditions prevail. The effectiveness of the slot is measured in terms of a cooling length which in turn is defined as the maximum distance over which the wall temperature remains below a fixed ratio to the stagnation temperature of the coolant. The purpose of the investigation is to establish the effect of coolant quantity, and coolant quality on the cooling length. It is analytically demonstrated that the cooling length is proportional to the square of the mass flow of the coolant with a proportionality coefficient which depends at most on the coolant quality. In a numerical analysis it is shown that under the conditions of high speed flow the cooling length coefficient is a function of the coolant Mach number; however, the values obtained vary over such a narrow band that for practical purposes it may be taken as a constant. The coolant of a wing section is investigated by considering a 50 ft. circular wing as an example. It is shown that the results obtained for the constant pressure flow carry over with little modification to flows with pressure gradient. Furthermore, it is shown that a small amount of coolant injected through the slot in the leading edge is sufficient to cool the whole wing. Author (TAB)

N69-17682# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIFIC FEATURES IN MEASURING HEAT CONDUCTIVITY COEFFICIENTS OF MULTILAYER INSULATIONS
L. B. Golovanov 18 Apr. 1968 18 p refs Transl. into ENGLISH from the Russian
(AD-679687; FTD-HT-23-13-68) Avail: CFSTI CSCL 20/13

The report describes a method and the instrument used to measure the heat conductivity coefficients of multilayer insulations. The plane instrument described measures the heat flow through the insulation specimen by means of two methods simultaneously: according to the quantity of liquid vaporized and the capacity of the heater. Comparison with a cylindrical instrument shows that the cylindrical instrument is highly accurate, but it cannot measure the insulation heat conductivity coefficient at various loads.
Author (TAB)

N69-17790*# Aerotherm Corp., Palo Alto, Calif.
FURTHER STUDIES OF THE COUPLED CHEMICALLY REACTING BOUNDARY LAYER AND CHARRING ABLATOR. PART 1: SUMMARY Final Report
E. P. Bartlett, W. E. Nicolet, L. W. Anderson, and R. M. Kendall 15 Oct. 1968 81 p refs
(Contract NAS9-6719)
(NASA-CR-92471; REPT-68-38-Pt-1) Avail: CFSTI CSCL 20M

The primary result of this effort was the development of a number of computer codes applicable to charring ablation materials and chemically reacting laminar boundary layers and the initiation of a turbulent boundary layer development. These programs can be operated independently or used in conjunction with each other to obtain various degrees of coupling. The basic programs predict the transient in-depth response of charring ablation materials, the chemical state of open or closed systems, nongrey radiation flux distributions, and nonsimilar laminar multicomponent chemically-reacting (equilibrium) boundary layers. The codes are the charring material ablation program, boundary layer integral matrix procedure, aerotherm chemical equilibrium program, and coupled ablator/boundary layer/environment program. Author

N69-17791*# Aerotherm Corp., Palo Alto, Calif.
FURTHER STUDIES OF THE COUPLED CHEMICALLY REACTING BOUNDARY LAYER AND CHARRING ABLATOR. PART 3: A NONGREY RADIATION TRANSPORT MODEL SUITABLE FOR USE IN ABLATION-PRODUCT CONTAMINATED BOUNDARY LAYERS

William E. Nicolet 15 Oct. 1968 63 p refs
(Contract NAS9-6719)
(NASA-CR-92473; REPT-68-38-Pt-3) Avail: CFSTI CSCL 20M

A prediction method is described which can be used to obtain nongrey radiative fluxes or intensities at any point within a plane-parallel slab (for the flux calculation) or at any point on a ray (for the intensity calculation). The method was developed for the study of radiation heating phenomena in the mass injected, hypersonic boundary layer environment; however, it is not limited to such studies. The radiative properties model assumes local thermodynamic equilibrium and considers the continuum transitions, molecular bands and atomic lines of the species of the C–H–O–N elemental system. The smeared line model for the molecular bands is the only approximation which is an integral part of the method. Any of the other aspects of the properties model can be made to include as much (or little) detail as desired, allowing tradeoffs to be made between accuracy and computational effort. Author

N69-17806# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF RADIATIVE HEAT TRANSFER BETWEEN BODIES SEPARATED BY AN ABSORBING MEDIUM
A. R. Fert et al 16 Apr. 1968 12 p refs Transl. into ENGLISH from Izv. Vysah. Ucheb. Zaved., Energ. (Minsk), v. 10, no. 2, 1967 p 70–75
(AD-679688; FTD-HT-23-16-68) Avail: CFSTI CSCL 20/13

The article is a theoretical study of radiative heat transfer in an IR heating unit with particular regard to the effect of the medium between the radiator and the material to be heated. It is assumed that this medium has radiative and absorptive properties and is isothermal. The calculations are based on classical formulas of radiative heat exchange between parallel infinite planes separated by a given distance (ranging from 50 to 1000 mm in the case of infrared heating. Author (TAB)

N69-17878# Naval Research Lab., Washington, D. C.
THEORY OF AFTERBURNING IN A LOW ALTITUDE ROCKET EXHAUST PLUME Interim Report
Richard Shao-lin Lee (State Univ. of N. Y., Stony Brook) and W. W. Balwanz 15 Oct. 1968 59 p refs
(AD-679664; NRL-6801) Avail: CFSTI CSCL 21/2

An improved aerodynamic model is proposed for the exhaust plume issuing from a low-altitude rocket nozzle exit into quiescent ambient air in which chemical reactions and compressibility predominate. The model is based on the presently available knowledge and established aerodynamic principles for the various flow regimes involved. The major assumptions made are individually substantiated by related experimental evidence in existing literature. A theoretical analysis is carried over the whole flow region based on the Karmans integral approach to find solutions for the gross aerodynamic and thermodynamic behavior of the plume. Theory incorporating on empirically derived constants provides the required radial distribution function for the integration. Solutions are obtained for the velocity, density, temperature and chemical composition fields for extended regions of the plume. These results will provide the much needed framework for the understanding of the elements which contribute to the phenomenon of radar attenuation of rocket exhaust plumes. Author (TAB)

N69-17908# Institut Franco-Allemand de Recherches, St. Louis (France).
THE EXPLOSIVE CHARGE USED FOR THE DETONATION TENACITY TESTS [DER SPRENGSATZ FUER DIE SPRENGZAEHIGKEITSPRUEFUNG]
H. Haensel 18 Sep. 1967 18 p refs in GERMAN
(ISL-T-34/67) Avail: CFSTI

The explosive charge for burst resistance tests contains the explosive and the detonation capsule. An exact determination of their combined effectiveness on the shocked material is necessary. Relevant parameters for the production of effective explosive charges are discussed and a method for testing their degree of effectiveness is described. Author

N69-17919# Institut Franco-Allemand de Recherches, St. Louis (France).
THE UTILIZATION OF THE FIRING TECHNIQUE IN THE SCRAMJET EXPERIMENTS [UEBER DEN EINSATZ DER SCHIESSTECHNIK IN DER SCRAMJET-FORSCHUNG
H. Behrens 25 Sep. 1967 7 p in GERMAN
(ISL-N-5/67) Avail: CFSTI

Presented lectures depict the construction and instrumentation of a shock tunnel for supersonic combustion studies at 10 to 20 Mach. Also discussed is the use of scramjet models containing gaseous or liquid propellants for aerophysical studies based on free flight range measurements. The last experiment uses shadow photography to visualize shock flows caused by combustion during high speed shots in explosive gas mixtures. Transl. by G.G.

N69-17920# Institut Franco-Allemand de Recherches, St. Louis (France).
TEMPERATURE MEASUREMENTS OF FLAME JETS FROM EROSION BOMBS [TEMPERATUREMESSUNGEN AN FLAMMENSTRAHLEN AUS EROSIONSBOMBEN]
H. Mach 9 Jun. 1967 41 p refs in GERMAN
(ISL-T-21/67) Avail: CFSTI

Photometric and spectroscopic observations of metal erosion, caused by combustion gases from the propellant ignition flash leaving an iron nozzle, are reported. Continuous time solution photographs of fire flash spectra from three different powder combinations are used to determine the flame structure as well as black and colored temperatures. Optical density and real temperature calculations establish almost the same axial temperature of 2100°K for all investigated powder ignition flashes. This is attributed to the combustion effect of metal particles ejected from the iron nozzle during ignition. Transl. by G.G.

N69-17921# Institut Franco-Allemand de Recherches, St. Louis (France).
PRESSURE WAVE SPREADING IN AN EXPLOSIVE CHAMBER [DRUCKWELLENAUSBREITUNG IN EINEM SPRENGHAUS]
M. Froboese and G. Mathieu 7 Jun. 1967 34 p ref in GERMAN
(ISL-T-18/67) Avail: CFSTI

Pressure wave propagation measurements are made at several points during explosive detonations in combustion chambers and pressure peaks are correlated with explosive quantities. Increased pressures and prolonged pressure times caused by the contained spherical wave are analyzed. Results show that the shock wave undergoes a maximal damping of 70 dB by the steel concrete wall that separates the detonation chamber from the laboratory and that acoustic waves propagate inside the chamber at varying pressure peaks. Acoustic pressure peak measurements show a decrease with increased detonation intensities. Transl. by G.G.

N69-17922# Institut Franco-Allemand de Recherches, St. Louis (France).
THE AFTER BURNING OF ROCKET JETS INJECTED INTO REPOSING INERT GASES [DIE NACHVERBRENNUNG IN

RAKETENSTRAHLEN BEI AUSSTOSS IN RUHENDE INERTGASE]

H. Behrens and F. Roessler 7 Jun. 1967 33 p refs in GERMAN (ISL-T-20/67) Avail: CFSTI

Investigated are rocket exhaust combustions in carbon dioxide, nitrogen, and argon by stationary and scanning photography. Results show that low calory solid propellants jets undergo secondary combustion in inert gases caused by the reaction of the gaseous conical rarefied plume that contains dissociation products of the primary combustion. Combustion processes are qualitatively analyzed and practical as well as theoretical aspects are discussed. Author

N69-17926# Institut Franco-Allemand de Recherches, St. Louis (France).

DETERMINING THE SYNTHETIC CONTENT OF EXPLOSIVE SYNTHETIC MIXTURES [BESTIMMUNG DES KUNSTSTOFFGEHALTS IN SPRENGSTOFF-KUNSTSTOFF-GEMISCHEN]

W. Kegler and D. Grune 12 Jul. 1967 10 p refs in GERMAN (ISL-N-8/67) Avail: CFSTI

Described is a calorimetric method for determining constituent percentages in explosive-plastic mixtures and for predicting the explosive force of the mixed compounds. Explosives are combusted in hot water-carbon dioxide mixtures together with 50% pure hexogene. The amount of heat delivered by the pure hexogene is then substracted from the measured combustion temperature in order to establish the explosive temperature of the investigated material. Calorimetric data for hexogene and octogene mixtures with styrol-polyesters, and for hexogene and octogene mixtures with methacrylacid methylesters and dimethylacrylate are shown in table form. Transl. by G.G.

N69-17982# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.

EVALUATION OF DIRECT ELECTRICAL HEATING METHODS FOR THE DETERMINATION OF THERMAL CONDUCTIVITY AT ELEVATED TEMPERATURES Annual Progress Report, 1 Jul. 1967-30 Jun. 1968

Raymond E. Taylor, Reginald W. Powell, Migirdic Nalbantyan, and Frederick E. Davis Wright-Patterson AFB, Ohio AFML Oct. 1968 65 p refs

(Contract AF 33(615)-3861)

(AD-679639; AFML-TR-68-227) Avail: CFSTI CSCL 20/13

The report discusses the progress on a program for evaluating direct electrical heating methods for high temperature thermal conductivity determinations. A multi-purpose apparatus used in the evaluation of these methods, has generated data simultaneously on thermal conductivity, electrical resistivity, total hemispherical emittance and spectral emittance (0.65 microns) to 1900 K under high vacuum. Problems associated with emittance are extremely important in thermal conductivity determinations at high temperatures using direct heating methods. Great care must be taken to insure that the emittance remains constant over the central portion of the test specimen. The mathematical techniques used to compute thermal conductivity from the experimental data were explored and considerably advanced. These techniques eliminated the need for mathematical approximations which severely limit the region of applicability. One of these techniques was easily extended to the general case which includes three conductivity methods as special cases. Therefore, the need to match certain experimental conditions was eliminated. The inclusion of temperature-dependent physical properties was also readily included in this technique. The mathematical techniques also yielded temperature profiles which could be compared to the experimental profiles. Author (TAB)

N69-18003 Colorado Univ., Boulder.

FORCED CONVECTION HEAT-TRANSFER TO A MIXTURE OF SUBLIMING-PARTICLES AND VAPOR

Anthony Unwin Simpson (Ph.D. Thesis) 1967 213 p

Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-10627

Heat transfer to a mixture of subliming particles and vapor flowing in a uniformly heated tube is investigated. The mixture is formed when a cryogenic liquid is expanded through an orifice at the top of a tube to a pressure well below its triple point. A description and model of the process are proposed. General conservation equations are developed and then simplified to laminar boundary layer flow with uniform fluid properties over a flat plate. Polynomial approximations for the velocity and temperature profiles are introduced, and the results integrated across the boundary layers giving two simultaneous nonlinear ordinary differential equations describing the fluid-mechanical and thermal boundary layers. These are solved numerically, yielding the heat transfer coefficient and wall temperature as a function of distance along the tube. It was found that the theoretical and experimental wall heat-transfer coefficients agreed to within an average of thirty %. Dissert. Abstr.

N69-18022# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SELF-IGNITION AND THE INDUCTION PERIOD OF A DROP OF LIQUID FUEL

F. A. Agafonova et al 7 Jun. 1968 23 p refs Transl. into ENGLISH from Teplo.-i Massoperenos (Minsk), v. 4, 1966 p 241-251

(AD-679516; FTD-MT-24-130-68) Avail: CFSTI CSCL 21/2

The ignition of hexane, n-octane, and cetane droplets (0.0014-0.002 m in diameter) was studied by suspending the droplets from a quartz filament in a vertical tube through which preheated air was passed at velocities of 1.3-4.9 m/sec. The ignition process was studied by motion picture photography and induction time vs air temperature plots were obtained. A theoretical analysis yielded a formula for the dimensionless induction time. It is concluded that the studied fuels cannot ignite at the wet bulb temperature but they always ignite at a lower temperature. The induction time changes with the temperature of the medium faster than the temperature gradient across the droplet-medium interphase. Author (TAB)

N69-18037*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

ANALYSIS OF HEATING RATES AND FORCES ON BODIES SUBJECT TO ROCKET EXHAUST PLUME IMPINGEMENT

A. W. Ratliff, M. L. Blackledge, H. W. Butler, and D. E. Kooker Mar. 1968 110 p refs

(Contract NAS8-21150)

(NASA-CR-98329; LMSC/HREC-A791230) Avail: CFSTI CSCL 21B

Study effort was directed toward the development of engineering methods and computer programs for predicting convective heat flux and pressures in free molecular, transition and continuum flow regimes, for rocket exhaust plume impingement problems both solid and liquid rocket motors. Noncontinuum plume prediction techniques were investigated and a method was implemented into the plume flow field program. Radiant heating from both gaseous plumes and plumes with solid particles was treated with existing computer programs. This study produced and/or improved a set of computer programs and engineering methods for the prediction of heating rates and forces in jet plume impingement problems. This set comprises the following: (1) flow field program for plume predictions by real gas method of characteristics and free molecular theory; (2) thermochemical program; (3) general

impingement program; (4) set of programs for solid particle impingement and radiation; and (5) gaseous radiation program. Author

N69-18061*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMOPHYSICS RESEARCH AT MSFC
Gary M. Arnett, Harlan O. Burke, Gerhard B. Heller, Billy P. Jones, Edgar R. Miller et al *In its* Res. Achievements Rev., Vol. 2 1968 44 p refs (See N69-18059 07-34)
Avail: CFSTI CSCL 20M

Research on thermal problems is conducted by various laboratories at MSFC. Emphasis is placed on thermophysics as it pertains to space flight, especially with regard to radiation exchange with environment. Research on thermal problems of launch vehicles is also mentioned. Rocket base heating due to the effects of rocket engine jets and plumes in studied. The flow fields generated by the interaction of multiple rocket jets and the interaction with the surrounding air flow are investigated. Theories are being developed for radiative transfer from the rocket exhaust gases and from carbon particles in the S-IB and S-IC rocket engine plumes. Thermal engineering problems are involved in cryogenic research in connection with liquid hydrogen. This includes studies of zero-gravity heat transfer of liquid hydrogen. Author

N69-18076 Tennessee Univ., Knoxville.
AN ANALYTIC STUDY OF MICROLAYER EVAPORATION AND RELATED BUBBLE GROWTH EFFECTS IN NUCLEATE BOILING
Gerald Steven Dzakowic (Ph.D. Thesis) 1967 215 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-9798

An analytical model is proposed for the evaporation of the liquid microlayer which has recently been observed to separate a growing vapor bubble from the heated surface. A nonlinear heat flux boundary condition, which is derived from kinetic theory considerations, is introduced to describe the evaporation rate from the liquid microlayer; and the transient one-dimensional heat conduction equation is solved to obtain the heater surface temperature beneath the liquid microlayer. The waiting time between consecutive bubbles is analyzed in view of the variable wall temperature resulting from microlayer evaporation. The effect of internal heat generation is also included. Analytical results show that temperature excursions from microlayer evaporation produce longer waiting times. Dissert. Abstr.

N69-18083# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Advanced Development Program.
A FEASIBILITY STUDY OF GAS LIQUEFACTION USING VORTEX TUBES
F. Di Cuia and S. Pasik Nov. 1968 39 p refs
(FSR-AD7-05-68.3) Avail: CFSTI

A study was made to determine the feasibility of using vortex (Hilsch) tubes for liquefying gases (air, oxygen, and nitrogen). The study was primarily an experimental investigation of the use of the vortex tube in the air separation/liquefaction cycle. The experimental work performed indicated that the vortex tubes, unaided by regenerative cycles, heat exchangers, and expansion valves, cannot be used for generating liquid oxygen or nitrogen from compressed air; the coldest outlet temperature which was produced was −165°F, a temperature much higher than the liquefaction points of oxygen and nitrogen (−203°F and −320°F, respectively). Author

N69-18125*# Lockheed Missiles and Space Co., Palo Alto, Calif.
SERIES SOLUTION FOR HYPERSONIC FLOW ABOUT BLUNT BODIES
Y. S. Chou Washington NASA Feb. 1969 88 p refs
(Contract NAS7-509)
(NASA-CR-1266) Avail: CFSTI CSCL 20D

The Blasius type series formulation for hypersonic perfect gas flow over an axisymmetric blunt body was made. A three term series solution, based on the thin layer equations and a two term iterative solution based on the three term thin layer solution were obtained. Some of the conclusions reached were: (1) The present series solution seems most effective for a sphere; the convergence of the series is fast. The first two terms of the thin layer series are sufficient to describe the flow field accurately up to the sonic line and no iterative solution will be necessary. The concentric shock will be a good first approximation for a sphere. (2) For paraboloids, and for those body shapes will produce hyperboloidal shock waves, the present series solution is found to converge rather slowly, especially for the pressure field. The proposed iterative solution shows improvement over thin layer solution. (3) The thin layer equation is found to be applicable to ellipsoids with moderate bluntness such as the ones discussed in the examples. (4) The solution is not applicable at low free stream Mach numbers due to the hypersonic assumption made in the analysis as well as due to the fact that we have neglected the terms of order ϵ^2. Author

N69-18135# Argonne National Lab., Ill. Reactor Engineering Div.
TRANSIENT FREE-CONVECTION HEAT TRANSFER IN LIQUID METALS IN VERTICAL RECTANGULAR CHANNELS
Roger P. Heinisch May 1968 109 p refs
(Contract W-31-109-ENG-38)
(ANL-7452) Avail: CFSTI

An analytical and experimental investigation of transient free convection in a narrow, vertical, parallel-plane channel following a step change in uniform wall heat flux is presented. In the analysis, the time-dependent boundary-layer equations are formulated for two-dimensional flow and heat transfer with no internal heat generation and constant physical properties, except in the body-force term. These equations are solved by a technique generally referred to as the method of integral relations. The analysis is checked by using the method of lines to ascertain the validity of the results. The results obtained by the two methods are generally in good agreement. Solutions are obtained for various Prandtl numbers. Two boundary conditions are considered in the analysis: constant wall temperature and constant wall heat flux. Author

N69-18166 Florida Univ., Gainesville.
A STUDY OF LINE SOURCES FOR USE IN ATOMIC FLUORESCENCE FLAME SPECTROMETRY
Joseph Minor Mansfield, Jr. (Ph.D. Thesis) 1967 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-9537

This is an evaluation study of spectral line sources which have been found applicable for atomic fluorescence flame spectrometry. These sources include the metal-vapor arc discharge lamps, several varieties of the hollow cathode discharge lamp, and the Rf and microwave powered electrodeless discharge lamps. A detailed experimental investigation of microwave powered electrodeless discharge lamps as excitation sources for atomic fluorescence flame spectrometry is described. Important parameters associated with the radiational output of electrodeless lamps are identified by use of simple statistics. Analytically useful lamps are obtained for 14 chemical elements; and detection limits and analytical working curves are given for these. Dissert. Abstr.

N69-18263# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
COMPARISON OF COMBUSTION INSTABILITIES FOUND IN VARIOUS TYPES OF COMBUSTION CHAMBERS
Marcel Barrere and Forman A. Williams (California Univ.) 1968 43 p refs Presented at the 12th Intern. Symp. on the Combust., Poitiers, France, 14–20 Jul. 1968 Submitted for publication
(ONERA-TP-570) Avail: CFSTI

Combustion instabilities in motors and furnaces are contrasted under three separate headings: System instabilities involved in an essential way interactions between processes occurring in the combustion chamber and processes occurring in at least one other component of the system. Combustion chamber instabilities consist of unsteady phenomena that are localized within the combustion chamber. Intrinsic instabilities are inherent in the reactants themselves and would be observed if combustion were to occur in the absence of any external influences. The second category, combustion chamber instabilities, is again divided into three subcategories: Acoustic instabilities involve in an essential way the propagation of acoustic waves in the combustion chamber. Shock instabilities are characterized by the presence of steep-fronted finite-amplitude shock or detonation waves in the combustion chamber. Fluid dynamic instabilities are associated with the establishment of special kinds of flow patterns, such as vortices, in the chamber. Experimental and theoretical aspects of each of these types of instabilities are discussed separately. Characteristics of each type of instability are described, and the kinds of chambers in which each has been observed are indicated. Attention is given to surface-burning systems, such as solid propellant rockets and hybrid rocket motors, and also to volume-burning systems, such as liquid propellant rocket engines and both gas-fired and oil-fired industrial burners. Experimental procedures for investigating each type of instability are reviewed along with selected experimental results, and the character and state of development of the theoretical methods that have been used for describing each type of instability are compared. The review is an attempt to bring about discussions between specialists who study combustion instabilities in different systems. Classification according to the type of instability rather than the type of system can emphasize the similarities and differences that exist among combustion instability problems encountered in different systems. One resulting observation is that examples of system instabilities and of acoustic instabilities are common to all kinds of combustion systems. Author (ESRO)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-17291# Maryland State Roads Commission, Brooklandville. Bureau of Research.
STATEWIDE INVESTIGATION OF FLEXIBLE PAVEMENTS Final Report
Allan Lee and C. H. Chow May 1968 77 p refs Supported by the Bur. of Public Roads, Washington, D. C.
(PB-180264) Avail: CFSTI CSCL 13B

The investigation of flexible pavements reported herein was initiated in 1955. The emphasis has been on the deflection testing of high-type flexible paving sections throughout the State. Field measurements on pavement performance such as cracking and rutting were also included. The main purpose is to determine the structural behavior of flexible pavements in terms of maximum deflection measured by the Benkelman beam under the state environment. The report describes the review and evaluation of all deflection data obtained in Maryland during the past thirteen years relative to the structural behavior or adequacy of flexible paving sections. Correlations were made between deflection and the following variables: (1) location of the wheelpath; (2) seasonal changes; (3) pavement age; (4) paved shoulder; (5) subgrade soil type; (6) pavement structural value; and (7) resurfacing thickness. Author (USGRDR)

N69-17315# NOLIT Publishing House, Belgrade (Yugoslavia).
BULLETIN OF THE BORIS KIDRIC INSTITUTE OF NUCLEAR SCIENCES, VOLUME 17, NO. 1
1966 75 p refs Transl. into ENGLISH of Bilten Inst. za Nuklearne Nauke "Boris Kidric" (Belgrade), v. 17, no. 1, 1966 p 1–70 Supported Jointly by AEC and NSF
(AEC-tr-6846/1) Avail: CFSTI

CONTENTS:

1. PROTONIZATION OF THE ARSENAZO III REAGENT IN CONCENTRATED SOLUTIONS OF PERCHLORIC AND SULFURIC ACID A. A. Muk et al p 1–8 refs (See N69-17316 07-06)

2. REACTION OF THE ARSENAZO III REAGENT AND ZIRCONIUM IN SOLUTIONS OF CONCENTRATED PERCHLORIC ACID A. A. Muk et al p 9–16 refs (See N69-17317 07-06)

3. THE BEHAVIOR OF ^{131}I IN POLYMETATELLURIC ACID IRRADIATED IN THE NUCLEAR REACTOR C. Teofilović p 17–27 refs (See N69-17318 07-24)

4. SYNTHESIS OF MALATHION LABELLED WITH ^{35}S OR ^{32}P AND DIPTEREX-^{32}P V. Jezdic et al p 28–36 refs (See N69-17319 07-06)

5. GRAIN GROWTH IN ALPHA-URANIUM D. Cerovic p 37–45 refs (See N69-17320 07-17)

6. EFFECT OF POSTIRRADIATION BLEEDING ON THE PROLIFERATION OF BONE MARROW CELLS IN MICE IRRADIATED WITH 350r: AUTORADIOGRAPHIC EXAMINATION USING THYMIDINE-^{3}H D. Karanovic et al p 46–52 refs (See N69-17321 07-04)

7. INFLUENCE OF DNA ISOLATED FROM DIFFERENT ORGANS ON THE REPARATION OF GERMINAL EPITHELIUM AND MORPHOLOGICAL CHANGES OF SPERMATOZOA OF TOTAL-BODY X-IRRADIATED RATS N. Savkovic et al p 53–62 refs (See N69-17322 07-04)

8. EFFECTS OF ACTINOMYCIN-D ON THE INCORPORATION OF 6-^{14}C-OROTIC ACID INTO THE RIBONUCLEIC ACID FRACTIONS OF RESTING RAT LIVER S. Petrovic et al p 63–69 refs (See N69-17323 07-04)

N69-17410*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLOW AND USE OF INFORMATION AT THE NATIONAL SPACE SCIENCE DATA CENTER
Nick Karlow and James I. Vette Jan. 1969 45 p refs
(NASA-TM-X-61445; NSSDC-69-02) Avail: CFSTI CSCL 05B

An integrative, overall view of the flow and use of information at the National Space Science Data Center (NSSDC) is presented by examining the tasks, present resources, and the flow of information. The information system used to handle this flow is then discussed in terms of its four main subsystems: the Automated Internal Management File, the Machine-Oriented Data System, the Technical Reference File, and the Request Accounting Status and History file. Also examined are five special purpose files: Computer Program Status Report, Magnetic Tape Unit Record, NSSDC Computer Program File, Rocket File, and Distribution File. This is followed by a look into the future of information systems development at NSSDC. Author

N69-17430# Toronto Univ., (Ontario). Inst. for Aerospace Studies.
AN OPTIMIZATION STUDY OF THE UTIAS IMPLOSION-DRIVEN HYPERVELOCITY LAUNCHER Mk 2
Robert F. Flagg and Gregory P. Mitchell Dec. 1968 81 p refs
(Contract AF 33(615)-5313)
(AD-679997; UTIAS-TN-130) Avail: CFSTI CSCL 14/2

A detailed study is presented of the optimization of the projectile velocity of the proposed UTIAS MK II Implosion-Driven, Hypervelocity Launcher. The projectile velocity was optimized with respect to four variables, namely explosive weight, initial loading pressure, hemispherical cavity size, and peak projectile acceleration or base pressure. The details of the dynamics of the waves which occur in the chamber and the dynamics of the projectile in the barrel were determined using a finite-difference computer program coded for use with the IBM 1130 computing machine. The code, which uses the von Neumann artificial viscosity technique to solve a set of nonlinear partial differential equations that describe the motion of the gas and projectile, did not contain such effects as radiative or convective heat losses, projectile - barrel friction, or ablation. The calculations therefore represent an ideal performance and set an upper bound on what can be expected in practice.
Author (TAB)

N69-17842# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
SIMPLIFIED METHODS FOR COMMUNICATING INFORMATION Technical Report, 1 Jan.–1 Jul. 1968
Gary B. McIntire Oct. 1968 39 p ref
(AD-680011; ASD-TR-68-45) Avail: CFSTI CSCL 5/2

The objective of the study was to find improved ways to present technical information. This report briefly discusses and gives examples of how information may be presented more effectively by the use of Decision Logic Tables, Graphic/Text Combinations, Checklists, and Matrices. These methods are applicable to handbooks, technical reports, and operating guides.
Author (TAB)

N69-17743# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
PROJECT SCHEDULING WITH RESOURCE CONSTRAINTS
Egon Balas Jun. 1968 28 p refs
(Contract Nonr-760(24))
(AD-679621; RR-147) Avail: CFSTI CSCL 5/1

Critical path and network flow techniques can solve project scheduling problems of a realistic size when there are no resource constraints; the introduction of the latter, however, changes the problem into one in which the number of variables and constraints depends on the number of time periods, and which existing methods can solve only for a very small size. The purpose of this paper is to reformulate the scheduling problem with resource constraints in a way that should eliminate the dependence of problem size on the number of time periods and should make this problem amenable to critical path - and network flow techniques. Thus, scheduling with resource constraints is shown to be equivalent to the problem of finding an optimal selection of arcs in a disjunctive graph with stability conditions. Simple machine sequencing and machine sequencing with sets of identical machines are shown to be special cases of this model. The scheduling problem with resource constraints can thus be solved by generating a sequence of PERT networks which satisfy certain stability conditions.
Author (TAB)

N69-17931# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MINISTRY AND SCIENCE
22 Jan. 1968 7 p Transl. into ENGLISH from Pravda (Moscow), 31 Jan. 1967 p 1
(AD-679709; FTD-HT-23-739-67) Avail: CFSTI CSCL 5/3

The reorganization of Soviet industry is discussed together with the reorganization philosophy. The effects of the reorganization that have already been realized are given and the interrelationship with the scientific community is outlined.
Author (TAB)

N69-17993# Office of Aerospace Research, Arlington, Va.
OAR PROGRESS, 1968
Joseph Seiden, ed. 1968 143 p refs
(AD-679700; OAR-68-0007) Avail: CFSTI CSCL 5/1

The report covers aspects of management, including finances, manpower, logistics, research information activities, and planning, and highlights some OAR achievements in the Defense Research Sciences and Exploratory Development. A bibliography is included to aid readers in obtaining detailed information on the research programs described.
Author (TAB)

N69-18048# Philippine Atomic Energy Commission, Manila.
NUCLEAR MAGNETIC RESONANCE, A LITERATURE SEARCH
May 1968 92 p refs
(PAEC(A)IN-674) Avail: CFSTI

Five hundred and fifty-nine references are presented on nuclear magnetic resonance under the following headings: biology and medicine; chemistry; engineering; geology; meteorology and mineralogy; instrumentation; isotope technology; metals, ceramics and other materials; physics, reactor technology; and general and miscellaneous.
NSA

N69-18057*# University of Southern Calif., Los Angeles.
EVALUATION OF THE GODDARD RESEARCH AND ENGINEERING MANAGEMENT EXERCISE SIMULATION
A. J. Rowe, P. Gruendeman, and D. McConaughy Washington NASA Feb. 1968 97 p refs
(Grant NSR-05-018-089)
(NASA-CR-1275) Avail: CFSTI CSCL 05A

Evaluated is a computer program designed to simulate the environment of a project manager involved in research and development activities of spacecraft management. The program uses a hypothetical spacecraft project—an orbiting optical observatory—which is described in a series of technical and administrative documents. The player-participant assumes the role of a project manager and is allowed to make decisions on schedules, costs, and hardware
G.G.

N69-18059*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ACHIEVEMENTS REVIEWS, VOLUME 2: SERIES 1 THROUGH 12
1968 651 p refs
(NASA-TM-X-53793-Vol-2) Avail: CFSTI CSCL 23

CONTENTS:

1. RADIATION PHYSICS RESEARCH AT MSFC R. D. Shelton 31 p refs (See N69-18060 07-22)

2. THERMOPHYSICS RESEARCH AT MSFC G. M. Arnett, H. D. Burke, G. B. Heller, B. P. Jones, E. R. Miller et al 44 p refs (See N69-18061 07-33)

3. ELECTRONICS RESEARCH AT MSFC D. L. Anderson, G. A. Bailey, J. F. Blanche, J. L. Hayes, R. L. Kurtz et al 47 p refs (See N69-18062 07-09)

4. MATERIALS RESEARCH AT MSFC C. E. Cataldo,

J. E. Curry, R. L. Gause, J. E. Kingsbury, and E. C. McKannan 55 p refs (See N69-18063 07-06)

5. QUALITY AND RELIABILITY ASSURANCE RESEARCH AT MSFC J. B. Beal, R. L. Brown, L. C. Hamiter, Jr., and F. E. Wells 32 p refs (See N69-18064 07-15)

6. CHEMICAL PROPULSION RESEARCH AT MSFC K. B. Chandler, P. G. Haas, R. R. Head, J. R. Thompson, Jr., and R. G. Weitenbeck 55 p refs (See N69-18065 07-28)

7. CRYOGENIC TECHNOLOGY RESEARCH AT MSFC R. L. Gause, D. A. Gilstad, E. H. Hyde, C. D. Nevins, J. M. Stuckey et al 92 p refs (See N69-18066 07-18)

8. COMPUTATION RESEARCH AT MSFC 10 p (See N69-18067 07-08)

9. POWER SYSTEMS RESEARCH AT MSFC R. Acker, R. J. Boehme, W. L. Crabtree, W. H. Goodhue, C. B. Graff et al 68 p (See N69-18068 07-03)

10. TERRESTRIAL AND SPACE ENVIRONMENT RESEARCH AT MSFC M. Alexander, S. C. Brown, D. W. Camp, C. C. Dalton, L. W. Falls et al 87 p refs (See N69-18069 07-13)

11. MANUFACTURING ENGINEERING RESEARCH AT MSFC R. T. van Aller, F. J. Beyerle, C. R. Cooper, R. V. Hoppes, R. L. Nichols et al 81 p refs (See N69-18070 07-15)

12. INSTRUMENTATION RESEARCH FOR GROUND TESTING AT MSCF T. L. Greenwood, H. S. Harman, H. G. Lackner, A. M. Payne, and A. E. Schuler 43 p refs (See N69-18071 07-14)

N69-18132*# Denver Research Inst., Colo. Industrial Economics Div.
TECHNOLOGY TRANSFER: A SELECTED BIBLIOGRAPHY
M. Terry Sovel 11 Nov. 1968 109 p refs
(Contract NSR-06-004-063)
(NASA-CR-99333) Avail: CFSTI CSCL 05B

This is a comprehensive compilation of 428 works on the subject of technology transfer. *Technology* is considered here to be technical information, including scientific knowledge, making possible the conception, development, design, production, and distribution of goods and services. *Transfer* here means the effective communication of such information from one person or source to a recipient who accepts it for consideration and possible application. The bibliography contains chiefly primary sources, and outdated information has been eliminated. K.W.

N69-18171 National Lending Library for Science and Technology, Boston Spa (England).
THE RADIATION BALANCE OF THE VERTICAL SURFACES OF A BUILDING
G. V. Cicenko [1968] 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 207, 1967 p 94–100
(NLL-M-7486-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Results are given of a calculation of the radiation balance of the surface of walls and glazed windows of a building, taking account of their orientation. The author considers the special features of the annual variation of the radiation balance of the surface of walls and windows in particular climatic regions of the USSR. Author

N69-18176# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 196
14 Jan. 1969 102 p refs Transl. into ENGLISH from Russian
(JPRS-42250) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–11 refs (See N69-18177 07-30)
2. METEOROLOGY p 12–40 refs (See N69-18178 07-20)
3. OCEANOGRAPHY p 41–45 refs (See N69-18179 07-13)
4. TERRESTRIAL GEOPHYSICS p 46–72 refs (See N69-18180 07-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 73–91 refs (See N69-18181 07-31)

N69-18196# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
Nov. 1968 52 p refs
Avail: CFSTI

Scientific research reviews are presented on inelastic electron scattering from magnesium-25 and ionic transport in potassium chlorides. For abstracts of these articles see N69-18197 and N69-18198, respectively. Significant technical progress on individual projects of the research and development program is summarized briefly. The specific areas considered are: astronomy, fuels, surface chemistry and lubricants, energy conversion, electronics, metallurgy, nuclear physics, optical physics, radar, and engineering instrumentation. S.P.

N69-18258# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
Dec. 1968 33 p refs
Avail: CFSTI

Results of continuing progress are reported. Articles are presented on the following topics: (1) a frequency monitoring system for application to naval shipboard communication networks; (2) the trivacancy contribution to the ionic conductivity of alkali chloride single crystals; and (3) a preservative lubricant for small arms, developed from an amino acid compound, which is to provide protection against sea water corrosion. Significant progress on individual projects or problems in the fields of physical metallurgy; ocean technology; radio propagation; electronic and nuclear paramagnetism; and sound propagation is summarized. A list of published reports for the year 1968 is also included. (For individual titles see N69-18259 through N69-18261.) A.C.R.

N69-18285*# California Univ., Berkeley. Space Science Lab.
SYSTEMS ANALYSIS AS A TECHNIQUE FOR SOLVING SOCIAL PROBLEMS: A REALISTIC OVERVIEW
Ida R. Hoos Oct. 1968 13 p refs Presented at the Application of Computers to the Probl. of Urban Soc., N. Y., 18 Oct. 1968 /*its* Internal Working Paper No. 88
(Grant NGL-05-003-012)
(NASA-CR-99344) Avail: CFSTI CSCL 05

A critical evaluation in the form of an essay is presented of present applications, weaknesses, and potential applications of systems analysis in solving socio-economic problems. K.W.

N69-18288*# National Aeronautics and Space Administration, Washington, D. C.
ANNUAL PROCUREMENT REPORT, FISCAL YEAR 1968
1968 84 p
(NASA-TM-X-61448) Avail: NASA Scientific and Technical Information Division CSCL 05A

NASA's procurement during Fiscal Year 1968 totalled $4,133 million. Approximately 83 percent was placed directly with business firms, and 8 percent with private firms through other government agencies. Sixty-seven percent of the direct dollar awards represented competitive procurements. An additional 10 percent represented follow-on contracts placed with companies that had previously been selected on a competitive basis. Awards on incentive contracts amounted to 52 percent of the total awards of $25,000 and over. Small business firms received $190 million or 6 percent of direct awards to business firms. In addition to these, small business received subcontracts from 85 prime contractors. During the year, 49 states and the District of Columbia participated in the prime contracts awards of $25,000 and over. Tables and charts showing the funds distribution are included. Author

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